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Volume 18, Number 6, March 31, 1964

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Volume 18, Number 6 March 31, 1964

NUCLEAR SCIENCE ABSTRACTS

BIOLOGY AND MEDICINE

General

8044 (ACRH-17) SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. (Argonne Cancer Research Hospital, Chicago). Mar. 1962. Contract AT(11-1)-69. 98p.

A separate abstract was prepared for one paper in this report. Other papers have been abstracted and appeared previously in NSA. A list is included of publications during the period covered. (C.H.)

For abstract of individual papers see: 8076.

8045 (AD-404119) RADIATION STERILIZATION OF FOODS. A Bibliography for 1957–December 1962. Charlotte C. Hutton, comp. (Defense Documentation Center, Arlington, Va.). 47p.

One-hundred and twenty-two references are presented covering various aspects of the use of radiation in processing foods. (C.H.)

8046 (NP-13507) ANNUAL REPORT OF THE NATIONAL INSTITUTE OF GENETICS, NO. 13, 1962. (National Inst. of Genetics, Mishima, Japan). 121p.

Results are summarized from genetic studies in insects, mice, Salmonella, plants, and man. Emphasis was placed on studies on Drosophila, silkworms, wheat, rice, and forest trees. Data are included from studies of mutations induced by x radiation in Drosophila, silkworms, Salmonella, wheat, and rice. A list is included of publications during the period. (C.H.)

8047 (NYO-2740-1) ANNUAL REPORT ON RESEARCH PROJECT. (Columbia Univ., New York. Radiological Research Lab.). Jan. 1, 1964. Contract AT(30-1)-2740. 196p.

Separate abstracts were prepared on 6 sections of this report. A list is included of publications during the period covered. (C.H.)

For abstracts of individual sections see: 8104, 8105, 8106, 8548, 8646, and 8647.

8048 (USNRDL-TR-689) LOW TEMPERATURE PRESERVATION OF MOUSE LYMPHOCYTES WITH DIMETHYL SULFOXIDE. M. J. Ashwood-Smith (Naval Radiological Defense Lab., San Francisco). Nov. 6, 1963. 25p. (AD-426982)

The successful preservation of mouse lymphocytes at −196°C with dimethyl sulfoxide is described. Viability of preserved lymphocytes was assessed by several in vitro techniques which included phase-contrast microscopy, motility studies, and protein synthesizing activity. The biological assessment of fresh and frozen lymphocytes was demonstrated in a splenomegaly assay system in which lymphocytes from mice of a parental strain were injected into F_1 hybrids. The results of both in vitro and in vivo tests indicated that more than 50 percent of the lymphocytes were viable after storage at −196°C for three months. Dimethly sulfoxide was shown to be superior to glycerol as a low temperature preservative agent for lymphocytes. (auth)

8049 THE PROBLEM OF HETEROTIC LETHALS. Janice B. Spofford (Univ. of Chicago). Am. Naturalist, 97: 67-8(Jan.-Feb. 1963).

Lethal-bearing chromosomes are discussed. Two methods are suggested for testing the hypothesis that the frequency of lethal-bearing chromosomes in a long-established population would tend to be higher than the initial value set by mutation-rate and negative selection, because of the class of lethals that are selectively maintained for considerable periods of time by close linkage to other selectively favored genes. (P.C.H.)

8050 A DEVICE FOR RAPID COLLECTION OF CELLS FROM RADIOACTIVE MEDIUM. Hsiang Ju Lin and Robert P. Geyer (Harvard School of Public Health, Boston). Biochim. Biophys. Acta, 75: 444-6(Nov. 29, 1963).

A device is described for the rapid collection of cells from a radioactive cell suspension by centrifugation. The device reduces loss of activity in cells used in metabolic studies. (C.H.)

8051 MUTANTS OF YEAST DEFICIENT IN CYTOCHROME C. Fred Sherman (Univ. of Rochester, N. Y.). Genetics, 49: 39-48(Jan. 1964).

Mutants of Saccharomyces cerevisiae which are partially deficient in the protein cytochrome c were studied. Mutants having a defective cytochrome c that was present at normal concentrations would not have been detected by the methods employed. It is of interest to note that no cy ρ^+ mutant was completely devoid of cytochrome c. Only cy_{3-1} ρ^+ (and cy_{3-1} md-cy_{3-1} ρ^+ due to the deficiency of cytochrome a) was found to have a decreased ability to utilize glycerol for growth. Results indicate that the cy_1 locus controls the structural protein, while the other loci are concerned with regulation. The action of these many regulatory genes is uncertain, but cytochrome c content is known to vary with the growth phase of a culture and the degree of aeration. (C.H.)

8052 L-ARABINOSE NEGATIVE MUTANTS OF THE L-RIBULOKINASE STRUCTURAL GENE AFFECTING THE LEVELS OF L-ARABINOSE ISOMERASE IN ESCHERICHIA

COLI. Richard Cribbs and Ellis Englesberg (Univ. of Pittsburgh). Genetics, 49: 95-108(Jan. 1964).

Genetic and enzymatic analysis of 17 L-arabinose non-utilizing mutants of Escherichia coli B/r, together with eight previously analyzed mutants of the B gene, show no relationship between the location of a mutant site in the B gene and its effect on the level of inducible L-arabinose isomerase, the product of the adjacent structural A gene. The results of reciprocal three-factor crosses were used to establish the linear genetic order of most arabinose negative mutants. Other mutants could not be ordered by this method because of high negative interference or close linkage. Recombination distances were used to establish the probable order of most of these mutants. (auth)

8053 A GENETIC MAP OF THE td LOCUS OF NEUROSPORA CRASSA. Y. Suyama, A. M. Lacy, and D. M. Bonner (Univ. of California, La Jolla). Genetics, 49: 135-44(Jan. 1964).

Two-point recombination data of 42 tryptophan synthetase mutants of Neurospora crassa were used to construct a genetic map of the td locus. Twenty-two mutants formed protein (CRM) serologically related to tryptophan synthetase; 20 were CRM negative. CRM positive mutants altered in similar functions appear to be clustered on the map. CRM negative mutants do not appear to be restricted to one region of the map. (auth)

8054 FINE STRUCTURE ANALYSIS AT THE td LOCUS OF NEUROSPORA CRASSA. Sam Kaplan, Yoshitaka Suyama, and David M. Bonner (Univ. of California, La Jolla). Genetics, 49: 145-58(Jan. 1964).

Recombination data were obtained from over 100 crosses of td mutants of Neurospora crassa. Previous fine structure genetic analyses at this locus have been based solely on two-point crosses owing to the lack of closely linked outside markers. By isolating a series of multisite mutants at the td locus the results obtained from two- and three-point crosses were compared. The results obtained from two- and three-point crosses employing CRM^+ marker mutations agree. For CRM-marker mutations the two sets of crossing data did not agree. Interference was highly negative with particular combinations of markers. (auth)

8055 PROCEEDINGS OF THE HANFORD SYMPOSIUM ON THE BIOLOGY OF RADIOIODINE, RICHLAND, WASHINGTON, JUNE 17-19, 1963. Health Phys., 9: 1083-1426 (Dec. 1963). New York, Pergamon Press, 1963.

Fifty-one articles are included; separate abstracts were prepared for 30. Thirteen articles were previously abstracted in NSA. The remaining 8 articles are brief summaries on chemical and physical nature of fallout I^{131} and carrier-free I^{131} released in air; uptake of I^{131} by freshwater organisms; iodine uptake from a single inhaled exposure; relation of milk secretion to iodine in milk; environmental I^{131} in children and aults—recent post mortem and whole-body counter measurements; radiopathology and dosimetry in the thyroid region of goitrous killifish fed I^{131} under euryhaline conditions; induction of neoplasms in thyroid glands of rats by subtotal thyroidectomy and by injection of 1 μC of I^{131}; and effect of varying stable iodine in diets of cows fed I^{131} on uptake of I^{131} in man drinking the milk. (P.C.H.)

For abstracts of individual papers see: 8066, 8067, 8068, 8069, 8070, 8071, 8072, 8073, 8083, 8084, 8085, 8086, 8087, 8088, 8089, 8090, 8159, 8160, 8161, 8162, 8163, 8234, 8235, 8236, 8237, 8238, 8239, 8240, 8241, and 8910.

8056 EFFECTS OF HISTOLOGIC AND HISTOCHEMICAL PROCEDURES ON THE INTENSITY OF THE LABEL IN RADIOAUTOGRAPHS OF CELLS LABELED WITH TRITIATED COMPOUNDS. Renato Baserga and Walter E. Kisielski (Northwestern Univ., Chicago and Argonne National Lab., Ill.). Lab. Invest., 12: 648-56(Oct. 1963).

Ehrlich ascites tumor cells were labeled in vivo with one of three tritiated compounds (thymidine, cytidine, or leucine) and, after 30 minutes, were examined by radioautography. Both Carnoy's solution and absolute methanol proved to be reliable fixatives, removing from cells equal amounts of radioactivity. The fixative-soluble radioactivity presumably represents the fraction of precursor that has not been incorporated into nucleic acids or proteins. Treatment with ribonuclease or cold perchloric acid removed all radioactivity from cells labeled with tritiated cytidine, a precursor of ribonucleic acid, but not from cells labeled with tritiated thymidine. Treatment with deoxyribonuclease removed radioactivity incorporated into deoxyribonucleic acid, but it also affected to a lesser extent the ribonucleic acid label. A comparison of sections and smears from the same sample indicated that, in smears of cells labeled with tritiated leucine, some of the silver grains in the radioautographic emulsion overlying the nucleus are due to radioactivity incorporated into the thin layer of cytoplasm interposed between the nucleus and the emulsion. (auth)

8057 ESTABLISHMENT AND STABILITY OF CHIMERISM BETWEEN TWO CLOSELY RELATED LINES OF MICE. A. J. S. Davies, Sheila M. A. Doak, and Elizabeth Leuchars (Royal Cancer Hospital, London). Nature, 200: 1222-3(Dec. 21, 1963).

Skin grafts and isografts were exchanged between two strains of mice, CBA and CBA/T6T6 (CBA containing T6 marker chromosome). All interstrain grafts between CBA and CBA/T6T6 were rejected but with prolonged rejection times, indicating that the two strains do not differ at the H-2 locus. CBA/T6T6 spleen cells were injected intravenously into new-born CBA mice; all injected mice survived and were tolerant to CBA/T6T6 skin grafts 6 weeks after injection, but no CBA/T6T6 cells were found in the spleen, bone marrow, or thymuses. CBA mice were irradiated and then injected with CBA/T6T6 bone marrow, and at intervals some of the mice were subjected to cytological analysis. Donor cells were found to dominate at all doses, and no host cells were seen after 700 r. The stability of the chimeras is discussed. (D.L.C.)

8058 THE ACTION SPECTRUM OF AN IN VITRO DNA PHOTOREACTIVATION SYSTEM. Jane K. Setlow and Maxon E. Boling (Oak Ridge National Lab., Tenn.). Photochem. Photobiol., 2: 471-7(1963).

The wavelength-dependence of in vitro photoreactivation of transforming DNA by yeast extract was determined. There is an intensity-dependent lag at the beginning of the biological reaction. There is a similar lag in the splitting of thymine dimers by the yeast extract in the light, a process known to account for most or all of the increase in transforming activity of photoreactivated DNA. The most efficient wavelengths for photoreactivation are around 3550 and 3850 Å. Although the action spectrum is not very similar to flavin absorption, riboflavin at very low concentration inhibits photoreactivation, as it also inhibits a number of flavoenzymes, suggesting that the photoreactivating enzyme might be a flavoprotein. (auth)

8059 TUBERCULOSIS IN HIROSHIMA. Raymond W. Turner and Dorothy R. Hollingsworth (Atomic Bomb Casu-

alty Commission, Hiroshima and Nagasaki). Yale J. Biol. Med., 36: 165-82(Oct. 1963).

The prevalence of tuberculosis was determined in the Adult Health Study of the Atomic Bomb Casualty Commission in Hiroshima. In the 1958 to 1960 sample 16.8 per cent of the men and 10.5 per cent of the women were found to have tuberculosis on a retrospective review of chest films and clinical records. Radiation exposure was not related to prevalence or radiologic extent of disease. Although it is quite possible that an increase in tuberculosis might have been present in the irradiated survivors of the immediate post bomb period, no such trends are noted in the followup of the present survivors. Other factors investigated in this study included the prevalence of pleurisy, extra-pulmonary tuberculosis and diabetes. Bacteriologic studies, chemotherapy, and occupational correlations are discussed briefly. (auth)

8060 STERILIZATION OF SUTURES. (to American Cyanamid Co.). British Patent 942,374. Nov. 20, 1963. Priority date Feb. 27, 1962, United States.

A method is discussed for sterilization of a collagen or silk suture by exposure to 1-Mev gamma rays for 2.5 megarads. The suture is sealed in a glass container and exposed to a Co^{60} source after which the glass turns brownish, thus confirming irradiation. The sterilization is shown not to appreciably reduce the tensile strength of the suture. (R.E.U.)

Ecology

8061 (ORNL-3530) GROWTH AND MOVEMENT OF SMALLMOUTH BUFFALO, ICTIOBUS BUBALUS (RAFINESQUE), IN WATTS BAR RESERVOIR, TENNESSEE. R. E. Martin, S. I. Auerbach, and D. J. Nelson (Oak Ridge National Lab., Tenn.). Jan. 20, 1964. Contract W-7405-eng-26. 104p.

The smallmouth buffalo fish, Ictiobus bubalus (Rafinesque), population of Watts Bar Reservoir, of the Tennessee River down stream from Oak Ridge National Laboratory, was investigated in order to describe its age distribution, growth rates, dispersion, and importance as an accumulator of radionuclides. Measurements and scale samples were taken from commercially-caught fish and fish caught in the ORNL tagging operations. Scale impressions were analyzed for age and growth phenomena. Dispersion of smallmouth buffalo was investigated by conventional tagging methods and by autoradiographic analyses of scales. Stable and radiochemical composition of scales was examined by spectrographic analysis, flame spectrophotometry, and radiometric surveys. Calcium was the most abundant element in fish scales with at lease twenty-three other elements present in varying quantities. Fish scales and bone were found to contain radionuclides of ruthenium, cesium, zirconium, zinc, and cobalt. Radiometric surveys of scales revealed the Watts Bar Reservoir smallmouth buffalo population was a relatively minor accumulator of radionuclides with only 0.08 per cent showing the presence of artificially produced radionuclides. Approximately 6 per cent of the Clinch River fish and 77 per cent of the White Oak Creek fish had accumulations. Limited data on dispersion were determined from conventional tags. Much more dispersion and life history data were determined from autoradiographic analyses of scales. These dispersion data were applied only to individuals because the number was too small for generalizations for the population as a whole. All normal scales containing radionuclide accumulations were found to produce identical autoradiographic patterns of concentric circles which were associated with growth of the fish in contaminated areas. This phenomenon was combined with conventional capture-recapture methods of population estimates in a proposed technique of population studies. A laboratory experiment showed that scales could be tagged with cesium-134, but this radionuclide was found to accumulate in much larger concentrations in the soft tissues than in the bony tissues. (C.H.)

8062 (SC-DC-3553(p.195-207)) MARINE SCIENCES RELATED TO AEROSPACE USES OF NUCLEAR POWER. Arnold B. Joseph (Division of Biology and Medicine. Environmental Sciences Branch, AEC).

The path and lifetime of radioisotopes in the biosphere are predicted in terms of hazards introduced by aerospace nuclear systems. The safety of operating nuclear devices in the oceans is considered. (R.E.U.)

8063 (AEC-tr-6049(p.258-70)) THE CONTENT AND DISTRIBUTION OF RADIOACTIVE SUBSTANCES IN FOOD PRODUCTS. (Translation)

The entry of fallout into biological cycles is discussed. Basic routes of entry into the human organism are reviewed. Results are summarized from studies on the mechanisms of Sr^{90} entry from fallout into various food products. Emphasis is placed on distribution in plants and especially grain plants. The routes of Sr^{90} and Cs^{137} incorporation in milk are discussed. Data are presented on the Cs^{137} and Sr^{90} contents in samples of milk collected throughout the world from 1957 through 1960. Possible health hazards from Sr^{90} in milk are discussed. (C.H.)

8064 (JPRS-22656) THE EFFECT OF CESIUM CONCENTRATION ON ITS ACCUMULATION IN PLANTS. A. A. Titlyanova. Translated from Dokl. Akad. Nauk SSSR, 152: 441-2(1963). 4p. (OTS-64-21238)

Data are presented from studies on the absorption of Cs^{137} by pea plants and wheat plants from feed solutions and from soil when various concentrations of Cs were used. Cesium reactions in soil-solution systems are discussed. Results indicate that the Cs bond with soil changes with variation in its concentration. (C.H.)

8065 REPTILES OF THE NEVADA TEST SITE. Wilmer W. Tanner and Clive D. Jorgensen. Brigham Young Univ. Sci. Bull., Biol. Ser., 3: No. 3, (Oct. 1963). 36p.

Results are reported from an ecological study of reptiles of the Nevada Test Site. Twenty-nine species of reptiles were found, including one tortoise, thirteen lizards, and fifteen snakes. The effects of nuclear detonations were apparent on the distribution of reptiles near ground zero. The degree of disturbance decreased outward from ground zero. Food and suitable habitat were the main factors affecting the distribution of reptiles. (C.H.)

8066 BIOLOGICAL DISPOSITION OF RADIOIODINE. A REVIEW. M. Eisenbud and M. E. Wrenn (New York Univ., New York). Health Phys., 9: 1133-9(Dec. 1963).

A review is presented on the deposition and behavior of I^{131} in man's environment. The routes of human absorption of I^{131} and the relative importance of these routes are discussed. (P.C.H.)

8067 DEPOSITION OF IODINE ONTO PLANT LEAVES FROM AIR. P. J. Barry and A. C. Chamberlain (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Health Phys., 9: 1149-57(Dec. 1963).

The effect of light intensity and relative humidity on the

absorption of airborne I^{131} in tracer concentrations onto attached leaves of broad bean (Vicia fava) was determined. It is shown that the rate of absorption onto leaves is controlled by the rate of diffusion of the gas through stomata on the leaf surface. The relative humidity is the most important factor in determining the deposition. In dry air the rate was a tenth or less of that in humid air. (auth)

8068 FOLIAN SORPTION OF I^{131} BY PLANTS. F. P. Hungate, J. F. Cline, R. L. Uhler, and A. A. Selders (General Electric Co., Richland, Wash.). Health Phys., 9: 1159-66(Dec. 1963). (HW-SA-3142)

The sorption of I_2^{131} by leaves was tested under both laboratory and field conditions. The amount of I^{131} sorbed was proportionate to the concentration of the gas surrounding the leaves over wide ranges of concentration. Similar proportionality was also noted for the sorption of I^{131} to filter paper. Although a significant portion of the I^{131} was shown to be inside the leaf, there was little translocation to other plant parts. The extent of I^{131} deposited from a melted fuel element under field conditions could not be correlated with pubescence of exposed leaves though some of the deposited material appeared to be particulate. Only 50 per cent of the I^{131} was removed from leaves with water although 90 per cent was potentially removable, as shown with other agents. Much less I^{131} was inside the leaves of plants exposed to the fuel element off-gas than in leaves exposed to I_2^{131} in the laboratory, because in the field test, conditions favored closure of the stomata and much of the activity was particulate. (auth)

8069 THE RELATIONSHIP BETWEEN I^{131} CONCENTRATIONS IN VARIOUS ENVIRONMENTAL SAMPLES. J. K. Soldat (General Electric Co., Richland, Wash.). Health Phys., 9: 1167-71(Dec. 1963). (HW-SA-2887)

A study was made of the relationship between I^{131} concentrations in air, vegetation, milk, and cattle thyroids in the vicinity of Hanford during the period January 1961, through April, 1963. Some insight into mechanisms of I^{131} passage down the food chain to man is provided and the rate at which I^{131} concentrations decrease following relatively acute depositions of fallout materials is illustrated. The major source of the I^{131} was fallout of debris from nuclear weapons tests. Concentrations noted during periods of testing were 10–100 times those found when no testing was in progress. Fresh milk constituted the principal mode of intake of I^{131} for persons residing in the Hanford environs. Concentrations in milk samples collected from local dairy farms averaged about 50 pC I^{131}/l during 1961, and 40 pC/l during 1962. The potential radiation dose received by a small child (with a 2 g thyroid) via milk consumption was estimated to be about 400 times that received via inhalation during the period under study. For an adult (with a 20 g thyroid) the ratio of thyroid exposure via milk to that via inhalation was estimated to be about 40 to 1. (auth)

8070 VEGETATION RETENTION AND VEGETATION—MILK RATIOS OF FALLOUT I^{131}. A. P. Hull (Brookhaven National Lab., Upton, N. Y.). Health Phys., 9: 1173-7(Dec. 1963). (BNL-7083)

Environmental monitoring results for I^{131} at Brookhaven National Laboatory during the past autumn appear consistent with the reported deposition velocity of 0.5 cm/sec and a rainfall factor on grass of 0.5. Values for the average I^{131} concentrations in grass and milk at locations in the Brookhaven environs suggest a ratio of 1 μC/kg of grass to 0.070 μC/l of milk. These values are in approximate agreement with Windsale data. (Auth)

8071 COOPERATIVE FIELD STUDIES ON ENVIRONMENTAL FACTORS INFLUENCING I^{131} LEVELS IN MILK. Health Phys., 9: 1187-95(Dec. 1963).

Data collected by the Division of Radiological Health, U. S. Public Health Service, were examined and showed geographic variation in radionuclide concentration in milk. The data show that milk is an excellent indicator of I^{131} from specific intrusions that occur anywhere in the country, depending upon meteorological and climatological conditions. Observed I^{131} levels in milk may be reduced by removing animals from pasture and substituting previously harvested and stored hay for contaminated pasture. More detailed studies of pasture versus stored feeding support quantitative finds in a qualitative way and indicate a period of rapid elimination (half life of 16 hr for 2 days) followed by a period of slow elimination (effective half life of about 7 days). Fertilization of pasture land can increase pasture yields and reduce radioactive concentrations in the feed and milk. (auth)

8072 RADIOIODINE UPTAKE IN NATIVE ANIMALS AT THE NRTS AND ENVIRONS. R. McBride (Idaho Operations Office, AEC). Health Phys., 9: 1227-30(Dec. 1963).

Native animals (jack rabbit, chipmunk, and kangaroo rat) at the National Reactor Testing Station were analyzed for I^{131} uptake while living in their native habitat and under laboratory conditions. In each case the uptake and the biological effective half life of I^{131} in the thyroid was determined. Year-to-year comparisons were made of stack releases of I^{131} from the chemical fuel-processing plants and the amounts of I^{131} found in animals at different downwind distances. The quantity of radioiodine found in the animal thyroid was proven to be an extremely sensitive indicator of area contamination not only from local sources but also from nuclear weapons testing. (P.C.H.)

8073 QUANTITATIVE RELATIONSHIPS BETWEEN FALLOUT RADIOIODINE ON NATIVE VEGETATION AND IN THE THYROIDS OF HERBIVORES. F. B. Turner (Univ. of California, Los Angeles). Health Phys., 9: 1241-6(Dec. 1963). (TID-18763)

Following the Sedan test of July 6, 1962, the time-specific relationships between I^{131} on vegetation and in jack rabbit thyroids were measured and compared to predictions derived from a deterministic model. The accord is considered good enough to encourage further application of this approach to environmental problems involving food-chain transfers of radioisotopes. Disparities between predicted and observed levels are reviewed in terms of possible sources of error in estimating input parameters. The value of considering this type of problem probabilistically is emphasized and a stochastic revision of the model is derived. (auth)

8074 DECORPORATION OF RADIONUCLIDES (INVESTIGATION OF RADIORUTHENIUM). Dietrich Seidel, Alexander Catsch, and Karl-Heinz Schweer (Kernforschungszentrum, Karlsruhe, Ger.). Strahlentherapie, 122: 595-610(Dec. 1963). (In German)

The behavior of carrier-free Ru^{106} in the organism of the rat is characterized by a relatively uniform distribution over the organs and tissues, by a marked affinity toward the plasma proteins, and by a slow blood clearance. Among several chelating agents tested, the most pronounced reduction of Ru^{106} retention was exhibited by diethylenetriaminepentaacetic acid and, particularly, by 1:2-bis-[di(carboxymethyl)aminoethylthio]ethane. The binding of Ru^{106} by these compounds is more stable than that by the

proteins. Nevertheless, the efficacy of the chelators administered with a delay is completely abolished. It is very likely that the tendency of the Ru(III)-ion to form sluggishly exchanging chelates with the proteins is the responsible factor. The diuretic Diamox proved to be ineffective. (auth)

8075 RADIOBIOLOGICAL INVESTIGATIONS WITH CHROMIUM-LABELED ERYTHROCYTES. II. THE ERYTHROCYTE LIFETIME OF AWAKENED AND HIBERNATING DORMICE. Hans A. Kuenkel, Hans-Joerg Mauss, and Konrad Fischer (Universität, Hamburg). Strahlentherapie, 122: 611-17(Dec. 1963). (In German)

Using the radiochrome method, the survival of the erythrocytes in the peripheral blood of dormice was determined in a normal state, during hibernation, and after waking. The survival was 91 days normally, 270 days during hibernation, and 64 days after waking from a 4 week period of hibernation. A change in the survival time of the erythrocytes could not be observed after total body irradiation with 800 r. The hemoglobin-value decreased slowly during the hibernation period. (auth)

Metabolism, Tissue Distribution, and Toxicology

Refer also to abstracts 8559 and 9319.

8076 (ACRH-17(p.26-32)) THE PRODUCTION OF AN ERYTHROPOIETIC FACTOR BY THE IN SITU PERFUSED KIDNEY. J. W. Fisher and B. J. Birdwell (Argonne Cancer Research Hospital, Chicago).

Results are reported from a study of the role of the kidney in the production or activation of erythropoietin. Fe^{59} incorporation into erythrocytes was measured, and erythropoietin titers were measured in plasma following perfusion of dog kidney with blood containing Co as a stimulant of erythropoietin production. Comparison was made with erythropoietin levels in an isolated lung perfused in the same manner. Results show that the dog kidney, when isolated in situ, can be stimulated with Co to manufacture or release an erythropoietic factor. (C.H.)

8077 (CONF-381-1) PHOTODYNAMIC EFFECTS IN BIOLOGICAL SYSTEMS. John D. Spikes and Camillo A. Ghiron (Utah. Univ., Salt Lake City). [1963]. Contract AT(11-1)-875. 23p.

From International Symposium on Physical Processes in Radiation Biology, Ann Arbor, Mich., May 1963.

Photodynamic action is defined as the killing or chemical alteration of an organism, cell, or virus, or the chemical alteration of a molecule by light in the range of 300 to 800 μ in the presence of a photosensitizing dye and molecular oxygen. Results are reviewed from a number of recent studies of photodynamic effects in biological systems. Mechanisms of photodynamic action are discussed. Data are included from a comparison of the photodynamic and γ inactivation of trypsin. 126 references. (C.H.)

8078 (HW-SA-3222) DETERMINATION OF THE AVERAGE Cs-137 BODY BURDEN IN A POPULATION BY URINALYSIS. H. E. Palmer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [1963]. Contract AT(45-1)-350). 9p. (CONF-212-6)

From 9th Annual Bioassay and Analytical Chemistry Conference, San Diego, Oct. 1963.

Results of studies of high Cs^{137} body burdens in Alaskan Eskimos showed a good correlation between body burden and urinary excretion rate. Composite samples of urine from groups of people can be analyzed with the help of this correlation to obtain values of the average body burden of Cs^{137} for the group. (C.H.)

8079 ISOTOPIC COMPOSITION OF THE OXYGEN EVOLVED BY ILLUMINATED SPINACH CHLOROPLASTS AND GRANA WITH $K_2C^{18}O_3$ AS A TRACER. Babette K. Stern (Univ. of Chicago). Biochim. Biophys. Acta, 75: 340-8(Nov. 29, 1963).

The isotopic composition of the O_2 evolved in the Hill reaction by illuminated spinach chloroplasts and grana, using $K_2CO_3^{18}$ as a tracer, was determined. The results indicated that water O was the precursor of the O_2 evolved in the Hill reaction. The O_2 contained a small amount of isotope which appeared to be derived from water O that had exchanged with $K_2CO_3^{18}$. Spinach chloroplasts and grana were found to accelerate the rate of exchange of O between $K_2CO_3^{18}$ and water. (auth)

8080 THE PASSAGE OF STRONTIUM-90 THROUGH THE PLACENTA. T. V. Vorozheikina and Yu. D. Parfenov. Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 907-10(Aug. 1963).

Strontium-90, entering the maternal body of rats, passes to the fetus through the placenta. This phenomenon intensifies with the development of ossification processes in the embryo and is in direct proportion to the embryo's weight. It decreases with the progress of time lapse following the isotope administration. Radiation doses received by the embryo during intrauterine development are sufficiently high to be fraught with the hazard of essential developmental disturbances. (auth)

8081 ABSORPTION OF I^{131} BY THE THYROID GLAND IN ATHLETES DURING PHYSICAL EXERTION. I. S. Khorol (Central Research Inst. of Physical Culture, Moscow). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 962-4(Nov. 1963).

Radioiodine absorption by the thyroid gland after prolonged physical exercise (3000 m race) was studied in 16 athletes, aged 20 to 24 years. Two hours after administration of the isotope the level of its accumulation in the gland was halved. In 24 and 72 hours the content of radioiodine in the gland was higher than in experimental conditions without physical exercise. The phenomenon described evidently reflects the normal reaction of the thyroid gland of athletes to habitual physical exercise. (auth)

8082 COMPETITION BETWEEN CALCIUM, STRONTIUM, AND MAGNESIUM FOR ABSORPTION IN THE ISOLATED RAT INTESTINE. J. Z. Hendrix, N. W. Alcock, and R. M. Archibald (Rockefeller Inst., New York). Clin. Chem., 9: 734-44(Dec. 1963).

Rats 1 to 2 mo old were placed on a low calcium or a low calcium and low magnesium diet. Absorption in isolated rat intestine was studied in vitro. Duodenal segments which actively took up and actively transported Ca^{45} well, actively took up and actively transported Sr^{85} well; where Ca^{45} active uptake and active transport were poor, that of Sr^{85} was low. The uptakes of Ca^{45}, Sr^{85}, and Mg^{28} by the gut tissue were greater than the amounts transported. Calcium, Sr, and Mg decreased the active uptake of Ca^{45} and Sr^{85} by the duodenum. Calcium decreased the rate of active transport to the serosal media of Ca^{45} and Sr^{85}. Calcium was more effective in decreasing the active uptake of Sr^{85} than was Sr. The active uptake of Ca^{45} by the ileum was reduced by Mg and Sr. The active uptake of Mg^{28} by the ileum was reduced by Ca. The rate at which Mg^{28} crossed and was taken up by the small intestine increased from the proximal duodenum

to the distal ileum. Calcium was actively transported by the colon. Calcium, Sr, and Mg appeared to share a common pathway for absorption by the gut, but in the various areas of the intestine the rate of absorption of a particular divalent cation and the degree of competition between the divalent cations varied. Therefore, the absorption of a particular cation may involve also other pathways. (auth)

8083 FACTORS INFLUENCING THE THYROID UPTAKE OF IODINE ISOTOPES FROM NUCLEAR FISSION. A REVIEW. L. Van Middlesworth (Univ. of Tennessee Medical Coll., Memphis). Health Phys., 9: 1197-1211 (Dec. 1963).

A review is presented on the physiological factors involved in the uptake of iodine isotopes (primarily I^{131}) from fallout by the thyroid gland in man. Respiratory intake, stable iodine intake, iodide ion metabolism, iodide loss by secretion and excretion, maternal, fetal, and newborn thyroid physiology, and differences in thyroid physiology are discussed. 109 references are included. (P.C.H.)

8084 THYROID UPTAKE OF RADIOIODINE FOLLOWING VARIOUS ROUTES OF ADMINISTRATION. D. H. Wood, E. E. Elefson, V. G. Horstman, and L. K. Bustad (General Electric Co., Richland, Wash.). Health Phys., 9: 1217-20(Dec. 1963). (HW-SA-3072)

Thyroidal uptake of radioiodine following various routes of administration was studied in young sheep utilizing a double tracer technique and three detection systems. Iodine-125 and I^{131} were given simultaneously by various combinations of intravenous, subcutaneous, oral, and topical routes. Thyroid burdens were determined using a whole-body monitor with a 9 × 4 in. NaI crystal, a modified Geiger-Mueller tube assembly, a 2 × 2 in. NaI crystal, and a 2 × 0.04 in. NaI crystal. Rates and per cent of uptake and effective half life were similar following the oral, intravenous, and subcutaneous routes of administration. A lower uptake and a longer effective half life were seen following topical administration. Variations that may be associated with age and season were observed. No correlation could be made between the per cent thyroid uptake and the location or total area of skin involved with topical application. Estimated total radiation dose to the thyroid from oral administration was 6-8 rad/μC, while that from topical administration was 2-3 rad/μC. (auth)

8085 METABOLISM OF Te^{132}–I^{132} IN LACTATING SHEEP. H. W. Casey, A. C. Case, R. O. McClellan, and L. K. Bustad (General Electric Co., Richland, Wash.). Health Phys., 9: 1223-6(Dec. 1963). (HW-SA-3073)

Lactating ewes were administered a single oral dose of Te^{132}–I^{132} containing small amounts of Te^{131} and I^{131}. Concentrations in the milk were measured during the first 4 days post ingestion. Less than 0.2% of the administered Te^{132} was secreted in milk for any 24 hr period. Comparative values reported for dairy cattle are 0.5% of the administered dose secreted during the first 6 days. Peak milk concentrations occurred between 24 and 36 hr after administration after which Te^{132} concentrations declined with an apparent half life of about 1 day. Plasma concentrations were approximately equal to those of milk for each sampling period. Although high concentrations of I^{132} were found in the milk at collection, with its rapid decay rate (2.2 hr half life), the concentration present 24 hr was dependent on the content of Te^{132}. The ratio of I^{131} to Te^{132} in the milk varied from 120 at 1 day after administration to approximately 45 at 4 days. Measurements for Te^{132} concentration in major tissues were performed for ewes sacrificed at 48, 72, and 96 hr after the Te^{132} administration. The highest concentration at 48 hr was found in the thyroid, kidney, and liver, which contained 0.006, 0.0014, and 0.004% of the administered dose per g, respectively. From these results and work on dairy cattle, it appears that Te^{132}–I^{132} would not represent a significant hazard to man following a contamination event involving pastures grazed by lactating animals. (auth)

8086 I^{131} IN MILK AND THYROID OF DAIRY CATTLE FOLLOWING A SINGLE CONTAMINATION EVENT AND PROLONGED DAILY ADMINISTRATION. L. K. Bustad, D. H. Wood, E. E. Elefson, H. A. Ragan, and R. O. McClellan (General Electric Co., Richland, Wash.). Health Phys., 9: 1231-4(Dec. 1963). (HW-SA-3074)

A single I^{131} contamination event of forage was simulated by administering I^{131}–labeled feed to dairy cattle twice daily for 31 days, all feed samples being spiked on day one with 5 μC I^{131} per sample. Peak milk concentration in the dairy cattle occurred on the fourth day with about 0.4% of the first day's dose of 10 μC observed per l of milk. The peak thyroid concentration in the cattle occurred after 1 week and was about 70% of the first day's dose of I^{131}. In a second study, 5 μC of I^{131} were fed daily to three cows starting before parturition and continuing for a period of 6 months of lactation. Apparent equilibrium of I^{131} in the thyroid was reached after 2 weeks and approached twice the daily feeding level. A suggestion of increased thyroid uptake occurred following parturition. The I^{131} concentration in the colostrum was 2-3 times that in the milk on the seventh day of lactation, after which time a gradual increase was observed. The per cent of the daily dose of I^{131} appearing in the milk varied from 0.4 to 1.0% over a 6-month period. Following an increase in the daily stable iodine content of the cow's diet from 5 mg to 2 g per day, milk concentration of I^{131} decreased 50% and thyroid concentrations decreased more than 90%. (auth)

8087 FALLOUT I^{131} IN CHILDREN—IN VIVO MEASUREMENTS. Frances I. Visalli and A. S. Goldin (Public Health Service, Winchester, Mass.). Health Phys., 9: 1271-7(Dec. 1963).

The relative importance of inhalation and ingestion as modes of entry of I^{131} from fallout into the thyroids of children was investigated during the fall of 1962, using as subjects fifteen children ranging in age from 6 to 14 years. One group of children was maintained on a regular diet, and the second on a restricted diet containing no radioactive iodine. The levels found in the children on the restricted diet were either zero or very small, demonstrating that ingestion was the predominating mode of entry. In a second phase of the investigation, the effect of NaI in reducing the uptake of I^{131} was studied by maintaining all the children on a regular diet and administering 0.5 mg NaI/day to seven of the children. Administration of stable iodide resulted in a smaller thyroid content, but did not completely suppress the uptake of radioiodine. Measurements were made in a small shielded room, using two 6.3 × 3.8 cm NaI(Tl) crystals. The limit of detectability of the system, with a 30-min counting time, was 30 pC I^{131} in the thyroid. (auth)

8088 HUMAN THYROID UPTAKE AND BODILY ELIMINATION OF I^{131} FOR THE CASE OF SINGLE AND CONTINUAL INGESTION OF BOUND IODINE IN RESIN-TREATED MILK. S. R. Bernard, B. R. Fish, G. W. Royster, Jr., L. B. Farabee, P. E. Brown, and G. R. Patterson, Jr. (Oak Ridge National Lab., Tenn.). Health Phys., 9: 1307-23(Dec. 1963).

Five human volunteers ingested resin-treated milk con-

taining protein-bound I^{131} for periods of time ranging from 1 to 63 days and in amounts ranging from 0.15 to 92 nC. In the first experiment all subjects ingested daily dosages of I^{131} for periods ranging from 4 to 63 days. Thyroid uptake was measured by γ scintillation countings of all subjects. Urinary excretion was measured on two subjects, one of which was followed for 67 days. In a second experiment, two subjects ingested a single dose each. Thyroid uptake and urinary excretion were measured as in the first experiment. Extrapolations were made from the single-intake data to the case of continuous intake and were compared with the daily intake data. From the data, estimates were made of f_w, f_1, f_2, and T_b for thyroid gland and were compared with ICRP and NCRP recommendations. (auth)

8089 EFFECT OF I^{127} ON THYROID UPTAKE OF INHALED I^{131}. W. J. Bair, M. D. Snyder, R. A. Walters, and R. F. Keough (General Electric Co., Richland, Wash.). Health Phys., 9: 1399-1410(Dec. 1963). (HW-SA-3202)

Rats were exposed to air containing I_2^{131} and I_2^{127} in various ratios. In the virtual absence of I_2^{127} the maximum levels of I^{131} in the thyroids were 20% of the total I^{131} deposited in rats on a diet normal in iodine and 40–50% in rats on a low-iodine diet. Maximum depression of I^{131} uptake in the thyroid, 0.05% of the total deposited, was obtained at the highest levels of I_2^{127}, 5 mg/l air, which approached the toxic limit. The levels of uptake were roughly equivalent to those obtained when rats were given 100 mg KI subcutaneously prior to exposure to I_2^{131}. Dilution of I^{131} vapor with stable iodine was much less effective in reducing the thyroid uptake of I^{131} in dogs. Inhalation of 50 mg I_2^{127} reduced the thyroid uptake by about one-half. (auth)

8090 EXPERIMENTAL STUDIES ON THE ELIMINATION OF RADIOIODINE FROM THE BODY. E. H. Graul, W. E. Stumpf, and G. Frerichs (Universität, Marburg, Eng.). Health Phys., 9: 1411-18(Dec. 1963).

An experimental study involving more than 250 guinea pigs was conducted in order to develop a therapeutic schedule for emergency treatment of acute radioiodine exposure. The effects of $KClO_4$, Iodine, TSH, and the diuretic hydrochlorthiazid, administered to animals in varying dosages at several time intervals following I^{131} uptake, were examined on thyroid and whole-body levels of I^{131}. $KClO_4$ proved more effective than iodine in blocking the uptake of I^{131} by thyroid. TSH treatment is contraindicated 24 hr after I^{131} administration. A combined treatment with TSH and $KClO_4$ gives optimal results at time intervals exceeding 24 hr after administration of I^{131}. It is proposed that gastric lavage (with injection of $KClO_4$) be used within the first few hours following I^{131} exposure. Ingestion of salivary secretions must also be avoided. (auth)

8091 ABSORPTION OF RADIOACTIVE COBALTOUS CHLORIDE IN HUMAN SUBJECTS. Karl R. Paley and Estelle S. Sussman (Lenox Hill Hospital, New York). Metab., Clin. and Exptl., 12: 975-82(Nov. 1963).

The adsorption of Co^{60} labeled cobaltous chloride under carrier-free (trace) and load conditions and the effects of protein binding of cobalt on such absorption were studied in a group of 37 human subjects. The results indicate that the absorption of cobalt is generally diminished when the cobalt is administered after a meal; pretagged to protein; or administered carrier-free wherein binding to residual protein in the digestive tract may be presumed to have occurred. This suggests that the absorption of cobalt takes place in the gastrointestinal tract above the region of protein digestion. (auth)

8092 THE RENAL EXCRETION OF Ca^{45} AND Sr^{85}. STUDIES OF THE CLEARANCES AND DISTAL TUBULAR REABSORPTION OF THE RADIOISOTOPES. G. F. Mazzuoli, G. A. Cinotti, E. Biagi, G. Coen, and S. Merendino (Università, Rome). Minerva Nucl., 7: 391-4(Oct. 1963). (In Italian)

The mechanism of renal discrimination between calcium and strontium was investigated in dogs using stop-flow analysis and renal clearance following the intravenous injection of Ca^{45} and Sr^{85} administered simultaneously. Renal clearance of both radioisotopes was studied at normal urinary flow rate and during the progressive increase of urinary output, established by means of a hypertonic mannitol solution. Using stop-flow analysis, strontium, like calcium, was found to be actively reabsorbed by the distal tubule but did not appear actively lowered in concentration in proximally derived samples. Preferential urinary excretion and higher renal clearance of Sr^{85} than of Ca^{45} were noted at normal urinary flow rate; the ratio Sr^{85}/Ca^{45} clearance ranged from 5 to 6. As the rate of urinary flow increased the Sr^{85} clearance and Ca^{45} clearance increased together, but not in the same proportion. The ratio of Sr^{85}/Ca^{45} clearance decreased. This finding indicated that as tubular reabsorption of the two ions becomes less efficient, the renal discrimination between strontium and calcium decreases. At urinary flow higher than 5 to 6 ml per min the increase in strontium clearance showed a linear relation with that in calcium clearance, with the ratio of Sr/Ca clearance remaining more or less constant. Accepting the assumption that the distal tubule only slightly modifies the urine during mannitol diuresis, it would appear that the renal discrimination between strontium and calcium takes place mainly in the distal portion of the nephron. (auth)

8093 INFLUENCE OF DURATION OF EXPERIMENT ON RATE OF UPTAKE OF RADIOACTIVE POTASSIUM IN SMOOTH MUSCLE. H. Bauer, P. J. Goodford, and J. Hueter (Universität, Mainz). Nature, 200: 1104-6 (Dec. 14, 1963).

The rate of uptake of K^{42} from solutions by excised smooth muscles of guinea pigs was measured. The effect of duration of experiment on the rate of exchange of K^{42} was also investigated. Results indicate that K was not evenly distributed in muscle. No change was noted in the initial rate of uptake of K^{42} after in vitro incubation periods as long as 24 hr. (C.H.)

8094 CESIUM-137 IN THE BLOOD OF THE FINNISH LAPPS. Anneli Salo, Antti Alha, and Jorma K. Miettinen (Univ. of Helsinki). Nature, 200: 1119-20(Dec. 14, 1963).

A survey was made of the diet, health, whole-body content of Cs^{137}, and blood content of Cs^{137} of about 200 adult Lapps living in Finnish Lapland in May 1962. The body burden of Cs^{137} in Lapps was found to be about twice as high as in October 1961. It was concluded that the whole-body content of Cs^{137} can be determined from blood content when Cs^{137} values range from 200 to 1,500 pC/l of blood and when the dietary history of the people is known. (C.H.)

8095 INFLUENCE OF IODINE INTAKE ON IODINE DISTRIBUTION IN TROUT. J. B. Humm and E. P. Reineke (Michigan State Univ., East Lansing). Proc. Soc. Exptl. Biol. Med., 115: 91-3(Jan. 1964).

Iodine content of trout tissues is directly related to dietary and/or habitat water levels of iodine. With ample iodide in the water (10 μg/l), trout can extract iodide directly from water and maintain tissue iodine levels comparable to those of sea-run trout. High PBI levels were correlated with high plasma inorganic iodide. An isotopic

equilibrium method was applied to estimate the iodine content of trout tissues. (auth)

8096 ANTIBODY SUPPRESSION BY ANTIGEN HEAVILY LABELED WITH IODINE-131. Milo M. Webber (Univ. of California, Los Angeles). Science, 143: 142-3 (Jan. 10, 1964).

Antibody formation in rabbits was suppressed by tobacco mosaic virus heavily labeled with I^{131}. Animals were injected intravenously with virus containing 0.5 to 4.4 mC of I^{131} and after a period of 6 days were challenged with a new antigen, γ-globulin. Most irradiated animals did not produce detectable antibody. No signs of radiation sickness were noted. (auth)

8097 THE EVALUATION OF TOXICOLOGICAL ANALYSES. L. M. van Putten (Inst. of Radiobiology GO-TNO, Rijswijk, Netherlands). p.625-49 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

A review is presented on the main problems involved in the analysis of radioisotope intoxication. The recognition of internal contamination, quantitative analysis of the body burden, and evaluation of the hazard caused by a known body burden are discussed. (P.C.H.)

8098 LARGE SCALE BACTERIOGENIC FRACTIONATION OF SULFUR ISOTOPES. M. LeRoy Jensen (Yale Univ., New Haven) and N. Nakai. Vienna International Atomic Energy Agency, 1963, Preprint SM-50/12, 24p. (CONF-269-9)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

A two-step, rate-controlling process is postulated to explain the large-scale fractionation of sulfur isotopes by sulfate reducing anaerobes. The first step involves the formation of a SO_4^{2-} enzyme complex; the second is a S–O bond breaking step to form a SO_3^{2-} enzyme. If the latter is rate-controlling, pure culture experiments provide maximum fractionation of about 2.5% that is very similar to the fractionation obtained by direct inorganic reduction of SO_4^{2-} in the laboratory. Nevertheless, raw culture experiments resulted in more than 4% fractionation and some control lacking measurements in nature exceed even 7%. In addition, the large-scale kinetic isotopic effects that are produced by sulfate reducing bacteria do not occur during the reduction of SO_4^{2-} to organic S in plant cells. (P.C.H.)

Radiation Effects

8099 (BNL-7541) BIOLOGICAL EFFECTS OF THERMAL NEUTRONS AND THE $B^{10}(n,\alpha)Li^7$ REACTION. J. O. Archambeau, V. Alcober, W. Calvo, and H. Brenneis (Brookhaven National Lab., Upton, N. Y.). [1961]. Contract AT-30-2-GEN-16. 26p. (CONF-205-4)

From International Atomic Energy Agency Symposium on the Biological Effects of Neutrons Irradiation, Upton, N. Y., Oct. 1963.

The biological effect of the thermal neutron capture reaction of B^{10} ($B^{10}(n,\alpha)Li^7$) and the accompanying adventitious irradiation was documented on pig skin and dog brain. A maximal fluence of thermal neutrons that produces a healing radioepidermitis in pigs injected with 35 mg/kg of B^{10} 30 min prior to irradiation was estimated to be $5 \pm 0.5 \times 10^{12}$ n/cm^2. When fluences of 5×10^{12} n/cm^2 and greater were administered to the cortex of dogs injected 30 min prior to irradiation with 35 mg/kg of B^{10}, a non-healing necrotizing radioepidermitis resulted. Capillary hemorrhages and discoloration of the myelin stain was the most prominent lesions found as the dose was increased. The bone marrow depression and epidermitis necessitated termination of the period of observation at one week. (auth)

8100 (BNL-7542) DOSE-SURVIVAL CURVES FOR HeLa CELL CULTURES USING THERMAL NEUTRONS AND THE $B^{10}(n,\alpha)Li^7$ REACTION. J. O. Archambeau, R. M. Drew, and J. S. Robertson (Brookhaven National Lab., Upton, N. Y.). [1962]. Contract AT-30-2-GEN-16. 27p. (CONF-205-11)

From International Atomic Energy Agency Symposium on the Biological Effects of Neutrons Irradiation, Upton, N. Y., Oct. 1963.

The effects of 250-kvp x ray, thermal neutron irradiation, and the thermal neutron capture reaction of B^{10}, ($B^{10}(n,\alpha)Li^7$), on the ability of HeLa cells to proliferate were evaluated with multiple-event dose-survival curves. The dose-survival data following thermal neutron irradiation for cultures containing 10 μg of B^{10}/ml can be expressed by a single-event curve. Dose survival data having an inflection point are expressed as a composite curve consisting of a single-event and multiple-event fraction. The dose-survival data demonstrate a decreased radiosensitivity following dose fractionation or following irradiation in a N_2-CO_2 atmosphere. (auth)

8101 (BNL-7603) COMPARISON OF THE MORTALITY RESPONSE OF DIFFERENT MAMMALIAN SPECIES TO X-RAYS AND FAST NEUTRONS. V. P. Bond and J. S. Robertson (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract [AT(30-2)-Gen-16]. 33p. (CONF-205-12)

From International Atomic Energy Agency Symposium on the Biological Effects of Neutron Irradiations, Upton, N. Y., Oct. 1963.

Difficulties encountered in determining the relative biological effects of x, γ, and neutron radiations for various mammalian species are discussed. Pertinent data are reviewed on the effects of x, γ, and fast neutron radiations in mice, rats, and dogs. Data are included on the mortality response to heavy particle radiation from the $B^{10}(n,\alpha)Li^7$ reaction. No biophysical explanations were found for species differences in response to radiation. The data indicate a difference in the relative radiosensitivity of the intestine and bone marrow for x, γ, and neutron radiation and also indicate that this radiosensitivity is highly species dependent. (C.H.)

8102 (BNL-7620) DELAYED EFFECTS OF X-IRRADIATION ON THE CENTRAL NERVOUS SYSTEM OF THE MONKEY. William F. Caveness, Leon Roizin (Columbia Univ., New York. Coll. of Physicians and Surgeons); J. R. M. Innes, and Arland Carsten (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract [AT (30-2)-Gen-16]. 45p. (CONF-235-2)

From 2nd International Symposium on Effect of Ionizing Radiation on the Nervous System, Los Angeles, Aug. 1963.

The effects of exposure of a portion of the head to 3.5 Kr of 250 Kv x irradiation, given in a single dose at a rate of 350 r per minute, were determined in a series of Macaca mulatta, irradiated at 12 months of age. The exposure, with a posterior-anterior beam direction, tangential to the right cerebrum, was limited to the cerebral cortex, its coverings, and the immediately subjacent white matter, to a total depth of 1 cm. The maximum incidence was within the post and pre-central gyri at the level of the hand-face

area. Post-irradiation observations indicated an intermittent functional course, as expressed by electroencephalography, that began as early as 24 hr. The first changes consisted of amplitude asymmetries, without alteration in rate, between the irradiated and the contralateral homologous cortex, more readily recorded during sleep than in the waking state. Clinical signs were delayed for twenty weeks and then followed a course of interruption and change in character. Focal seizures preceded the advent, and did not persist with the progression, of hemiparesis. With the onset of clinical signs, the E.E.G. exhibited a different order and distribution of abnormality. In addition to the transient, paroxysmal seizure activity, there was a slowing in rate with an increase in amplitude that was soon reflected from the opposite hemisphere. Sacrifice at successive intervals following irradiation indicated anatomical changes at ultrastructure levels as early as 72 hr. Inflammatory reactions, glial response, alteration in dendritic arborization, synaptic surfaces, and cell pyknosis, in part or whole reversible, were recognized within two to four weeks. Following the establishment of clinical phenomena, there was evidence of old as well as more recent destruction of neural tissue. (auth)

8103 (CONF-317-4) EFFECTS OF PHOTODYNAMIC TREATMENT, ULTRAVIOLET RADIATION AND GAMMA RADIATION ON THE PHOTOSYNTHESIS AND HILL REACTION OF CHLORELLA. John D. Spikes and Dennis C. Hall (Utah. Univ., Salt Lake City). [1963]. Contract AT(11-1)-875. 6p.

From Proceedings of Symposium on Photosynthesis of Green Plants, Airlie, Va., Oct. 1963.

Data are summarized from studies on the photodynamic inactivation of photosynthesis and whole-cell quinone Hill reaction of Chlorella in the presence of added dyes after exposure to ultraviolet and γ radiation. A large number of dyes were examined for photodynamic effects, and Rose Bengal was selected for detailed studies. The Hill reaction activity fell off progressively with increasing dye concentration in photodynamic experiments, whereas little inactivation occurred if the algae were kept in the dark. Photosynthesis activity fell off rapidly with increasing dye concentration in both the light and dark, but activity was lost more rapidly in the light. Ultraviolet radiation caused a drop of 50% in photosynthetic rate after 3 min and a drop to zero after 5 min. The loss of both Hill reaction and photosynthetic activity was apparently linear with γ dose. No evidence was seen of photoreactivation in γ-irradiated algae. (C.H.)

8104 (NYO-2740-1(p.7-30)) DOSIMETRY. (Columbia Univ., New York. Radiological Research Lab.).

Studies of the relative biological effects of fast neutrons as a function of energy in whole mice and the eye lens of mice emphasized the necessity of continuous specimen rotation during irradiation, or a similar procedure, to assure uniform doses. It is pointed out that the planning of radiobiological studies and the selection of dosimetric techniques should take into consideration the problem of secondary particle equilibrium. The operation of a tissue equivalent gas multiplication chamber is discussed. The effect of source intensity was studied using the γ radiation from Na^{24}. Design modifications for the chamber are described. Design characteristics are described for a tissue equivalent plastic ionization chamber for use in the dosimetry of 3-Bev protons in mice. An ionization chamber is also described that was designed and fabricated for use in neutron capture therapy investigations performed in the external therapy beam of a medical research reactor. (C.H.)

8105 (NYO-2740-1(p.91-154)) BIOPHYSICS. (Columbia Univ., New York. Radiological Research Lab.).

Preliminary results are reported from studies on cataract induction in mice by intermediate and low doses of monoenergetic neutrons. The effects of dose, type and energy of radiation, degree of effect, and time were considered. Methods of data analysis and comparisons with the effect of x radiation are discussed. Programs were prepared for the IBM 7090 computer for the analysis of cataract data. Measurements of survival of irradiated HeLa cells in tissue culture indicated a periodic change in radiosensitivity of the cells. An attempt was made to demonstrate a difference in recovery time for cell populations exposed to Cs^{137} and x radiation. Periodic changes in radiosensitivity were noted in these cells also. Possible mechanisms responsible are discussed. Results are reported from studies of the characteristics of ultraviolet-induced mutants of Escherichia coli and the growth of bacteriophages on the mutants. (C.H.)

8106 (NYO-2740-1(p.155-98)) RADIOBIOLOGY. R. Rugh (Columbia Univ., New York. Radiological Research Lab.).

Progress is reported in studies of x-radiation induced anomalies in hybrid mice, structural and functional changes in the brain of rats resulting from x irradiation of the embryo, the effects of drugs alone or combined with refrigeration in protecting female mice against sterility induced by x radiation, the effect of age on the degree of hematological recovery from acute x radiation exposure in mice, an investigation of cyclic variations in the radiosensitivity of mice, the use of anomalous lymphocytes for the diagnosis of exposure to ionizing radiations or radiomimetic agents in mice, and acute pathological alterations in monkeys exposed to x radiation as fetuses. (C.H.)

8107 (NYO-10620) INVESTIGATIONS ON MUTABILITY OF POLYGENES. Final Report. R. E. Scossiroli (Pavis, Italy. Universita. Istituto di Genetica). Dec. 31, 1963. Contract AT(30-1)-2686. 13p.

Progress is reported in studies on the effect of spontaneous and induced mutations in the induction of quantitative genetic traits in plants. X radiation was used as the mutagenic agent when applied to seed or gametes. Preliminary data are presented for studies in wild tomato (Solanum pimpinellifolium), alfalfa (medicago sativa), and maize (Zea mays). Data are included from a study on the persistence of genetic variability under prolonged inbreeding in populations of the parasitic wasp, Habrobracon juglandis. A list is included of publications resulting from investigations carried out under this contract. (C.H.)

8108 (ORNL-3531) CHROMOSOMAL ABERRATIONS IN A NATURAL POPULATION OF CHIRONOMUS TENTANS EXPOSED TO CHRONIC LOW-LEVEL ENVIRONMENTAL RADIATION. B. G. Blaylock, S. I. Auerbach, and D. J. Nelson (Oak Ridge National Lab., Tenn.). Jan. 29, 1964. Contract W-7405-eng-26. 88p.

Thesis submitted to Univ. of Tennessee, Knoxville.

The salivary gland chromosomes of Chironomus tentans larvae collected from White Oak Creek, an area contaminated by radioactive waste from the Oak Ridge National Laboratory, and from six uncontaminated areas were examined for chromosomal aberrations. White Oak Creek populations were exposed to absorbed doses as high as 230 rads per year or about 1000 times background. Chromosomal maps were constructed to make a general com-

parison of the banding pattern of the salivary chromosomes of the C. tentans in the East Tennessee area with those of Canada and Europe. These maps were used as a reference in scoring aberrations. Fifteen different chromosomal aberrations were found in 365 larvae taken from the irradiated population as compared with five different aberrations observed in 356 larvae from six control populations, but the mean number of aberrations per larva did not differ in any of the populations. The quantitative amount of heterozygosity was essentially the same in the irradiated and the control population, but there were three times the variety of chromosomal aberrations found in the irradiated area. From this evidence it was concluded that chronic low-level irradiation from radioactive waste was increasing the variability of chromosomal aberrations without significantly increasing the frequency. It was also concluded that chromosomal polymorphism can be maintained in a natural population without superiority of the heterozygous individuals. (C.H.)

8109 (RTD-TDR-63-3077) INCAPACITATION OF THE GOAT FOLLOWING MASSIVE DOSES OF MIXED NEUTRON AND GAMMA RADIATION. Earl Rudder, Wayne C. Hall, and Sidney O. Brown (Texas. Agricultural and Mechanical Coll., College Station and Texas. Agricultural and Mechanical Coll., College Station. Research Foundation). Dec. 1963. Contract AF29(601)-5211. 236p. (AD-426777)

Hematological, physiological, and psychological response data resulting from massive doses of mixed gamma and neutron irradiation are presented for four exposure series involving 120 Spanish goats, 8 Angora goats, and 8 sheep. Doses and dose rates employed ranged from 158 rads to 50,694 rads at rates of 316 to 633 rads per minute. The doses were recorded as mid-line air doses. The physical features under which exposures have been carried out are described. 97 references. (C.H.)

8110 (TID-19861) A STUDY OF THE EFFECTS OF SUB-STERILIZATION DOSES OF RADIATION ON THE STORAGE LIFE EXTENSION OF SOFT-SHELLED CLAMS AND HADDOCK FILLETS. Annual Report, May 1, 1962–April 30, 1963. John T. R. Nickerson and Samuel A. Goldblith (Massachusetts Inst. of Tech., Cambridge). Contract AT(30-1)-3006. 45p.

The storage life of haddock fillets and of shucked, soft-shelled clams irradiated by 50,000 to 350,000 rad and held at 44 and 32°F was determined on the basis of bacterial count. Appreciable increases in storage times were observed, up to 24 days at 32°F after 350,000-rad irradiation. The types of bacteria present after irradiation and after storage were also determined. Organoleptic tests were made on fresh irradiated samples and on stored irradiated samples for irradiations up to 800,000 rad. It was found that haddock fillets cooked by deep-fat frying after irradiation by 400,000 to 800,000 rad were more acceptable than similar samples cooked by steaming. (D.L.C.)

8111 (TID-19942) RESEARCH PROJECT ON THE MEASUREMENT OF MUTATION RATES INDUCED BY DIFFERENT MUTAGENIC RADIATIONS AT WIDELY DIFFERENT INTENSITIES. Final Report. R. D. Brock (Australia. Commonwealth Scientific and Industrial Research Organization, Melbourne). [1961]. Contract IAEA 110/45/US. 14p.

An apparent dose rate effect showing chronic γ irradiation (0.426 rads/min) to be six times more effective than acute irradiation (360 rads/min) was demonstrated using three marker genes in tomato. Mutation frequencies were chronic irradiation 231.6×10^{-8}/rad/locus and acute irradiation 40.5×10^{-8}/rad/locus. This enhancement of the mutation frequency was shown to be directly related to the radiation sensitivity of the pollen. Increased sensitivity results in an increase of zygotic lethals (reduced seed set per fruit) and of mutation of the marker genes. Most of the mutation of the marker genes are chromosome deletions. The increased sensitivity of the pollen is not associated with the reduced dose rate of the chronic irradiation, but is due to the storage conditions during the extended time of irradiation. Both desiccation and aging increase the sensitivity of the pollen and result in increased mutation frequency. (auth)

8112 (TID-19964) DEVELOPMENT OF SELECTION METHODS FOR INDUCED SMALL MUTATIONS IN HIGHER PLANTS (WITH SPECIAL REGARD TO MUTATIONS OF YIELDING CAPACITY). Progress Report. Horst Gaul (International Atomic Energy Agency, Vienna). [1963]. Contract AT(30-1)-2619. 23p.

Barley seeds were x irradiated and a great number of normal-appearing M_2 plants were selected at random along with an equal number of random plants of the untreated barley variety. Individual progenies of these plants were grown through succeeding generations. The variability of some quantitative characters were studied from M_3 generation through M_4 generation and with some of the materials through M_5 generation. The characters of main interest were kernel yield, kernel size, and heading date. A comparison of the progenies of irradiated seeds with control progenies through three generations indicated that a considerable amount of genetic variance for these quantitative characters was induced by irradiation. It was further evident that micro-mutations affecting yield occurred more often than did vital-macro mutations and that their frequency was also much higher than that of chlorophyll mutations. (auth)

8113 (TID-19982) RESEARCH ON IRRADIATION OF NATURAL POPULATIONS OF SELECTED VERTEBRATES. Final Scientific Report. W. Frank Blair (Texas. Univ., Austin). [1961]. Contract AT(40-1)-1751. 12p.

Efforts were made to determine the effects on natural populations of periodic x irradiation of males at levels known to induce significant numbers of deleterious mutations. Populations of three mammals, the deer-mouse, the wood-mouse, and the house mouse (Peromyscus maniculatus, P. leucopus, and Mus musculus), and one amphibian, the mexican toad (Bufo valliceps), were selected because of availability and of variability in ecological parameters. The main populational parameter measured was size of the annual breeding population, which necessarily made each sub-project a relatively long-term one. The results were consistent from species to species in showing that all of the populations were able to maintain themselves against the pressures of increased mutation rate under the ecological conditions under which the studies were made. (auth)

8114 (TID-19991) MODIFICATION OF GENETIC DAMAGE PRODUCED BY IONIZING RADIATION. [Progress Report]. Irwin I. Oster (Institute for Cancer Research, Philadelphia). [1963]. Contract AT(30-1)-2618. 29p.

Progress is reported in studies on the genetic effects of radiation in Drosophila melanogaster. An attempt was made to define the spectrum of effects that radiation, characterized by different linear energy transfer properties, produces in the genetic material of the fruit fly. Data are

presented on the effects of x, γ, and fast neutrons on various developmental stages, the effects of various external environmental conditions, and the effects of irradiation of mature spermatozoa in the male and in the female. Cytological observations are described. (C.H.)

8115 (TID-20001) PHOTOINACTIVATION OF TRYPSIN AS SENSITIZED BY FLAVINS, METHYLENE BLUE AND EOSIN Y. Camillo A. Ghiron and John D. Spikes (Utah. Univ., Salt Lake City). Sept. 1963. Contract AT (11-1)-875. 164p.

The kinetics of the dye-sensitized photoinactivation of trypsin were investigated. The time course of the trypsin inactivation as measured by the three assays could be fitted to first-order kinetics. The rates of trypsin inactivation were identical as measured by the casein and BAEE assays. A more rapid rate of inactivation was observed as measured by the Hb assay (containing 5M urea), using flavins as sensitizers, but not when methylene blue or eosin Y were used as sensitizers. These results were interpreted by postulating the existence of a "damaged" class of molecules after irradiation which appears to be labile to 5M urea or to post-irradiation heating. A similar damaged class of molecules was observed during the inactivation of trypsin with gamma irradiation and self-digestion. The trypsin inactivation products were analyzed using the method of disc electrophoresis with columns of polyacrylamide gel, and by various other biochemical tests. A progressive loss of the trypsin bands was observed when the enzyme was inactivated by those procedures which produce a damaged class of molecules: flavin-sensitized photodynamic action, autolysis, ultraviolet irradiation, and gamma irradiation. No loss of the main trypsin band was observed when methylene blue and eosin Y were used as sensitizers. No changes were observed in the number of peptide bonds, free amino groups, or of chromogenic amino acid sequences after the photoinactivation of trypsin as sensitized by flavins and methylene blue. Some photobleaching was observed with the three dyes during the photodynamic reaction; in spite of this, the time course of the inactivation of trypsin remained first-order within experimental error. Deviations from first-order kinetics were observed for the flavin-sensitized photoinactivation of ribonuclease when the irradiation period was extended. It was found that trypsin had a "protective" effect on the amount of photobleaching of flavins in air and in a nitrogen atmosphere. Methylene blue showed this effect in a nitrogen atmosphere only. The time course of the photodynamic reaction was also followed by measuring the amount of oxygen consumed. The results obtained indicated that the assumption of a stoichiometric relation between the oxygen consumed and the amount of enzyme activity lost may not be valid. However, the present results were far from satisfactory. A possible way of obtaining significant data and a method of analysis of the data were indicated so that a comparison could be made with trypsin photoinactivation kinetics. In a few preliminary experiments along these lines it was found that the ratio of the initial rate of oxygen consumption to the initial rate of trypsin inactivation on the illumination varies greatly with the dye used. The ratio is 59 with methylene blue and 393 with riboflavin. These data lend strong support to the conclusion that the mechanisms of these two photodynamic reactions are different. On the basis of a comparative study of the dye concentration, enzyme concentration, pH-dependence, and oxygen consumption studies of the photoinactivation of trypsin as sensitized by flavins, eosin Y, and methylene blue, it was concluded that the mechanism of the photodynamic reaction was different for each of the three sensitizers. In addition, the kinetics of the flavin-sensitized photoinactivation of trypsin were found to be markedly different at pH 5 and 8, thus suggesting that the mechanism of this reaction may depend on pH. The kinetics of the dye-sensitized photoinactivation of trypsin experimentally obtained were compared with four main types of mechanisms which have been proposed to explain photodynamic action. The present results do not conform to any one of the mechanisms proposed. It is therefore concluded that photodynamic action is probably a class of reactions, the mechanism depending on the reaction conditions and on the sensitizer dye used. (auth)

8116 (TID-20008) TUMOR INDUCTION IN MAN FOLLOWING RADIUM AND THORIUM (THOROTRAST) ADMINISTRATION. W. B. Looney (Virginia. Univ., Charlottesville. School of Medicine). Jan. 3, 1964. Contract AT(40-1)-2889. 9p.

The pathology of tumor induction in man following the administration of either Th or Ra is discussed. Data are reviewed for luminous-dial painters, patients given thorotrast, and others known to have been exposed. It is concluded that little reliance can be placed on available data on the minimum total body content for tumor induction. (C.H.)

8117 (TID-20029) PHYSIOLOGICAL STUDIES ON CONGENITAL DEFORMITY IN MICE. ANALYSIS OF ACTION OF RADIATION AND RADIOMIMETIC TREATMENTS. Technical Progress Report, December 31, 1963. Meredith N. Runner (Colorado. Univ., Boulder). Jan. 1964. Contract AT(11-1)-1270. 21p.

Results are reported from studies of radioinduced congenital deformities in mice. Data are presented from an analysis of the effects of x radiation, anoxia, and fasting in all possible combinations of single and dual treatments. It was concluded that dual treatments provided an additive or potentiation effect as compared to single treatments. Teratogenic effects of fasting and anoxia occurred at specific loci on the axial skeleton, and each focus appeared to have a separate threshold for sensitivity. Possible reaction mechanisms involved are discussed. (C.H.)

8118 (USNRDL-TR-611) RADIOSENSITIVITY OF BIOELECTRIC FUNCTIONS OF RAT STOMACH AND CAECUM. B. E. Vaughan and A. K. Davis (Naval Radiological Defense Lab., San Francisco). Jan. 8, 1963. 32p. (AD-297747)

Experimental studies of electrolyte absorption in the gastrointestinal tract established the existence of both delayed and immediate irradiation effects, as measured by bioelectric energy production in excised stomach and caecum tissues maintained in vitro. The delayed effects are dose dependent and show a neutron RBE of 2.7 compared to x rays. Both effects are produced indirectly, and the gastric reduction in bioelectric power requires irradiation change in both the secretory epithelium and parasympathetic nerves. Hence, the differential radiosensitivity of stomach and caecum must be determined by indirect factors, undoubtedly biochemical, rather than by differences inherent in the composition of each tissue by itself. (auth)

8119 (USNRDL-TR-683) SPECIFIC SUPPRESSION OF WOUND HEALING IN MICE BY GRAFT-VS-HOST REACTION. L. J. Cole, P. C. Nowell, and W. E. Davis, Jr. (Naval Radiological Defense Lab., San Francisco). Oct. 14, 1963. 20p. (AD-425518)

Young adult (C57L × A)F_1 mice bearing full-thickness skin grafts from A/HeJ mice received a single dose of 500 rad x radiation, followed by intraperitoneal injection

of 6×10^6 lymph node cells from normal A/HeJ donors; controls were injected with inactivated A/HeJ lymph node cells (i.e., 2000 rads in vitro). Circular punch skin wounds through the donor skin graft and adjacent host skin were made 8 days later. The mice receiving the intact parental strain lymph node cells showed symptoms of transplantation disease, while the controls were free of such signs. Skin wound healing was assessed histologically in mice sacrificed 3 and 6 days after wounding, permitting a comparison of healing in the donor skin-versus-host skin on the same mouse. The findings indicate a definite, specific inhibition of wound healing in LAF_1 skin as compared to A-skin in the mice suffering from transplantation disease. In each of 7 mice examined 6 days after injection of A-strain lymphoid cells, healing in the grafted A-strain skin was definitely greater than in the host's own (LAF_1) skin. Thus, the LAF_1 skin at this time showed only minimal to early healing, while the wounds in the grafted A-skin were completely closed in 4 of 7 cases, of which 2 were healed. The possible theoretical basis for the specific inhibition of wound healing in graft-versus-host disease is briefly discussed. (auth)

8120 (JPRS-22556) CHANGES IN EPITHELIUM UNDER THE INFLUENCE OF RADIATION. Translated from Arkh. Anat., Gistol. i Embriol., 45: No. 10, 51-66 (Oct. 1963). 27p. (OTS-64-21184)

Separate abstracts were prepared for two sections of this report. (C.H.)

For abstracts of individual papers see: 8121 and 8122.

8121 (JPRS-22556(p.1-13)) REPARATIVE REGENERATION OF CUTANEOUS AND INTESTINAL EPITHELIA AT THE ANAL JUNCTION IN ACUTE RADIATION SICKNESS. K. M. Svetikova. Translated from Arkh. Anat., Gistol. i Embriol., 45: No. 10, 51-8(Oct. 1963).

The course of regeneration of cutaneous and intestinal epithelium was studied in the area of the anal junction in rats following subjection to a burn with an incandescent plate four days after exposure to a whole-body dose of 800 r x radiation. Histologic studies were also made on non-irradiated burned rats that served as controls. Results indicate the main factor inhibiting regeneration was the development of infection that was more pronounced in irradiated rats. Repair of cutaneous epithelium was faster than that of intestinal epithelium in both irradiated and control rats. (C.H.)

8122 (JPRS-22556(p.14-26)) CHANGES IN THE TRANSITIONAL EPITHELIUM AFTER THE ACTION OF IONIZING RADIATION. A. V. Zhuravlev. Translated from Arkh. Anat., Gistol. i Embriol., 45: No. 10, 59-66 (Oct. 1963).

Changes in the transitional epithelium of the bladder after exposure to a single dose of 3000 r x radiation were studied in rats. A comparison was made with changes in epithelium of the abdominal skin exposed to irradiation at the same time. Histologic findings and mitotic indexes at various times up to 60 days post-irradiation are reported. (C.H.)

8123 (JPRS-22613(Del.)) STUDIES IN REACTION OF CELLS TO THE EFFECTS OF EXTREME CONDITIONS. L. K. Lozina-Lozinskii (Lozina-Lozinskiy). Translation of p.114-24; 126-33; 6-13 of "Reaktsiya Kletok na Ekstremal'nye Vozdeystviya," Moscow-Leningrad, 1963. 42). (OTS-64-21215(Del.))

Separate abstracts were prepared for 3 papers. (C.H.)

For abstracts of individual papers see: 8124, 8125, and 8197.

8124 (JPRS-22613(Del.)(p.12-28)) CHANGE IN THE DESOXYRIBONUCLEASE ACTIVITY DURING X-RAY IRRADIATION. K. I. Pravdina. Translated from p.114-24 of "Reaktsiya Kletok na Ekstremal'nye Vozdeystviya."

The DNA-ase II activity was studied in the mitochondria and supernatant liquid of the liver and spleen of rats. In the spleen, DNA-ase II was most active. In experiments in vitro and in vivo x irradiation increased the DNA-ase II activity in the supernatant liquid of the spleen. The anaerobic irradiation of the mitochondria suspension partially prevented an increase in DNA-ase activity of the supernatant liquid of the spleen. (auth)

8125 (JPRS-22613(Del.)(p.40-51)) RADIORESISTANCE OF THERMOTOLERANT STRAINS OF ESCHERICHIA COLI. V. D. Zhestyanikov. Translated from p. 6-13 of "Reaktsiya Kletok na Ekstremal'nye Vozdeystviya."

Thermotolerant variants of bacteria able to form macrocolonies at 50° were obtained by a prolonged cultivation of E. coli B, B/r, and K_{12} on agar with eosine and methylene blue with gradually increasing temperatures. The radioresistance of the thermotolerant strains of E. coli B, B/r, and K_{12} does not differ from that of the initial cultures. The exception is a thermotolerant variant of E. coli B bred on the simple nutrient agar at 46°. The increase in radioresistance of this strain is connected with the formation of elongated forms. The experiments on heat reactivation of thermotolerant E. coli B and B/r did not reveal any difference in survival curves obtained with the strains incubated after x irradiation. (auth)

8126 (UCRL-Trans-1025) ACTION ON YEAST OF SOFT X RAYS (K OF IRON). F. Holweck and A. Lacassagne. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore), from Compt. Rend. Soc. Biol., 103: 60-2(1930). 5p.

Results are reported from studies on the effects of monochromatic soft x rays on the growth of yeast (Saccharomyces ellipsoideus). Effects of various dose levels on morphology are reported. (C.H.)

8127 EFFECT OF NITROGEN GAS, IRRADIATED WITH A BETA-RAY SOURCE, ON NITROGEN FIXATION IN CONTINUOUS CULTURES OF AZOTOBACTER VINELANDII. Bengt Zacharias (Karolinska Institutet, Stockholm). Acta Chem. Scand., 17: 2225-9(1963).

Negative and positive gas ions were found in nitrogen gas, irradiated with a Sr^{90} source. An increased nitrogen fixation in Azotobacter vinelandii supplied with positive gas ions was detected, compared to cells fed with non-irradiated gas or negative gas ions. The effect was found to be one of a decreased glucose consumption. (auth)

8128 CHANGES IN THE EXTRACELLULAR SPACE IN RADIATION SICKNESS IN RATS. Z. B. Zseboek and Gy. Petrányi, Jr. Acta Med. Acad. Sci. Hung., 19: 137-44(1963).

The inulin space in rats was determined before and at various intervals from 1 to 72 hr after exposure to 1500 r whole-body x irradiation. The inulin space diminished gradually until about the 65th hr post-irradiation when a sharp drop was followed by death. (C.H.)

8129 LIFE SPAN DIFFERENCES BETWEEN HAPLOID AND DIPLOID MALES OF HABROBRACON SERINOPAE AFTER EXPOSURE AS ADULTS TO X RAYS.

Arnold M. Clark, Helen A. Bertrand, and Robert E. Smith (Univ. of Delaware, Newark). Am. Naturalist, 97: 203-8(July-Aug. 1963).

The life span for haploid males and diploid males of Habrobracon serinopae was determined after exposure as adults to 60 kr of x rays. The diploid males have a longer duration of life than the haploid males. This indicates that the decrease in life span after irradiation is related to damage to the chromosomal material. Non-irradiated diploid and haploid males have the same life span. The primary damage leading to a decreased life span is different for the irradiated and non-irradiated groups. The mechanisms involved in the normal aging process are different from those involved in the decreased life span from x irradiation. (auth)

8130 RENAL HOMOTRANSPLANTATION IN MAN IN MODIFIED RECIPIENTS. David M. Hume, Joseph H. Magee, Myron Kauffman, Jr., Max S. Rittenburh, and George R. Prout, Jr. (Medical Coll. of Virginia, Richmond). Ann. Surg., 158: 608-44(Oct. 1963).

Studies are presented in six patients receiving renal homotransplants from non-twin donors. A cadaver donor was used in one instance, a brother or sister in three instances, and a mother or father in two. No attempt was made to match the subgroups of the blood between donor and recipient. All six kidney transplants functioned well enough to maintain the patient. The function of the transplant persisted up to death in two patients who died of complications of radiation aplasia. None of the patients, however, have yet passed the one-year milestone required for assessment of long-term results. Several factors relating to the early management of patients with renal homotransplants are discussed. (P.C.H.)

8131 EFFECT OF RADIATION ENVIRONMENT ON THE THERMAL RESISTANCE OF IRRADIATED SPORES OF BACILLUS SUBTILIS. J. J. Licciardello and J. T. R. Nickerson (Massachusetts Inst. of Tech., Cambridge). Appl. Microbiol., 11: 216-19(May 1963).

The degree of heat sensitization induced in spores of Bacillus subtilis by irradiation with gamma rays was not changed when irradiation was carried out at low oxygen tension (1 mm of Hg) as compared with irradiation in an air atmosphere. The degree of heat sensitization appeared to be slightly greater at pH 7.0 than at pH 4.5. The substrate was found to influence the degree of induced heat sensitivity with less of an effect produced in complex organic substrates. (auth)

8132 PRODUCTION OF PECTOLYTIC ENZYMES BY RHIZOPUS STOLONIFER SPORANGIOSPORES AFTER "LETHAL" GAMMA IRRADIATION. N. F. Sommer, Min T. Creasy, E. C. Maxie, and R. J. Romani (Univ. of California, Davis). Appl. Microbiol., 11: 463-6(Nov. 1963).

Gamma irradiated sporangiospores of Rhizopus stolonifer excreted pectolytic enzymes, which hydrolyzed pectin and macerated potato tuber discs, into the suspending medium. Pectin glycosidase, but not pectin methylesterase, activity developed regardless of the amount of radiation the spores had received, unless the dose exceeded about 1 megarad. The ability to produce pectolytic enzymes was found to be more radiation-resistant than the potential for colony formation or the ability to germinate. Spores made incapable, through irradiation, of forming colonies continued to produce pectolytic enzymes after a 6-day period following irradiation treatment. (auth)

8133 EFFECTS OF HEAVY HIGH ENERGY CHARGED PARTICLES. II. PRIMARY ATYPICAL EPITHELIAL HYPERPLASIA IN MOUSE SKIN AFTER EXPOSURE TO 10 Mev PROTONS, 20 Mev DEUTERONS, OR 40 Mev α-PARTICLES. Stuart W. Lippincott, John E. Jesseph, Charles P. Baker, Wenceslao G. Calvo, Cornelius R. Jansen, Kanti R. Rai, and Vicente Alcober (Brookhaven National Lab., Upton, N. Y. and Wake Forest Coll., Winston Salem, N. C.). Arch. Pathol., 76: 527-36(Nov. 1963). (BNL-6981)

The direct effects of ionizing particle bombardment upon mouse epidermis were investigated using an external beam of accelerator-produced monoenergetic, heavy, ionizing particles: 10-Mev protons, 20-Mev deuterons, and 40-Mev alpha particles. The arrangement was such that a cylinder of skin was bombarded with essentially uniform ionization limited to a total depth of 1-2 mm. Within 20 days after bombardment with each of the three types of particles, there developed atypical epithelial hyperplasia without underlying vascular or collagen alterations as predisposing factors. In some instances the epidermal lesions resulting from an exposure of 2000 to 5000 rad resembled the type of lesion considered in the skin of man to be carcinoma in situ. (P.C.H.)

8134 EFFECTS OF KINETIN, RED LIGHT, AND GAMMA RADIATION ON GROWTH OF DISKS OF BEAN LEAVES. Robert D. Powell and Mildred M. Griffith (North Carolina State Coll., Raleigh, N. C.). Botan. Gaz., 124: 274-78(June 1963).

Both red light and kinetin stimulated the growth of disks cut from the leaves of dark-grown bean seedlings. Red light plus kinetin gave a greater response than either treatment alone. Growth curves for the red light treated and dark controls appeared to be parabolic. In the presence of kinetin some deviation from a parabolic curve occurred in the early stages of growth. Gamma radiation of 10 kr inhibited cell division. This level of radiation also inhibited the growth of both dark controls and red light-treated disks. The growth of kinetin-treated disks was only slightly inhibited by radiation. Kinetin-treated disks exposed to red light were essentially unaffected by radiation. It is suggested that kinetin might serve to restore a factor that was removed as a result of radiation. (auth)

8135 THE MEAN LIFE SPAN OF RATS IRRADIATED AT DIFFERENT PERIODS OF POSTNATAL DEVELOPMENT. V. V. Kholin (Kirov Postgraduate Medical Inst., Leningrad). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 53: 634-6(July 1963).

Studies were made on the mean life span of rats in relation to the age of the irradiated animals and the dose of irradiation. The results indicate that the mean life span of animals depends on their age at the moment of irradiation and on the dose of irradiation. (P.C.H.)

8136 THE EFFECT OF SUBLETHAL ROENTGEN-RAY IRRADIATION ON THE INDUCTION PROCESS CAUSED BY TRANSITIONAL EPITHELIUM IN CONNECTIVE TISSUE. A. Ya. Fridenshtein (Gamaleya Inst. of Epidemiology and Microbiology, Moscow). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 53: 682-6(July 1963).

Guinea pigs were irradiated at different intervals after the onset of induction caused by the transplantation of transitional epithelium. A mixture of minced mucous membrane from the urinary bladder of 4 or 5 guinea pigs was transplanted homoplastically into the anterior abdominal wall of 140 guinea pigs. The results show that

irradiation on the 8th–11th day after transplantation, when the zone of induction consists of young osteogenic tissue, leads to a severe disturbance of osteogenesis and to the total abolition of the induction effect (absorption of bone) 10 days after irradiation. The intermediate forms of transformation of the connective-tissue elements into osteogenic cells, which were observed in the grafts on the 5th day, were less sensitive. The results indicate that the time of appearance of foci of extramedullary hemopoiesis is closely related to moment of transplantation of the epithelium and not to the time of irradiation. It was also found that a definite stage of differentiation is essential for the formation of hemopoietic tissue, and that this is reached in the zone of induction from 2 to 3 weeks after transplantation of transitional epithelium. (P.C.H.)

8137 A MODEL OF EXPERIMENTAL LUNG CANCER CAUSED BY INTRATRACHEAL INTRODUCTION OF RADIOACTIVE CERIUM. N. N. Kurshakova and A. E. Ivanov. Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 787-93(Aug. 1963).

Experimental cancer of the lungs in rabbits was induced with intratracheal administration of colloidal solution of cerium-144 fluoride at a dose of 25 μc. Tumors of the lungs were revealed in 30% of the animals between the 238th and 327th day after administration of the radiosubstance. Autographic and dosimetric determination of radiosubstance was done; the rate of its elimination from the lungs was also studied. (auth)

8138 IMPORTANCE OF THE PERIPHERAL INNERVATION APPARATUS IN THE GENESIS OF PERMEABILITY CHANGES IN A VASCULAR BARRIER AFTER EXPOSURE TO IONIZING RADIATION. N. I. Arlashchenko. Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 835-8(Aug. 1963).

A complete denervation of the iris of the right eye was attained in rabbits by division of the first branch of the trigeminal nerve with sympathetic fibers and of oculomotor nerve located in the immediate vicinity of the first branch of trigeminal nerve. The operation was carried out under visual control. Total irradiation of animals at a dose of 1000 r or local irradiation of the eye at the same dose disturbed the hematoophthalmic barrier permeability for the eye both on the operated and the intact side. Evidently, these disturbances had nothing to do with the intactness of the peripheral innervation apparatus. (auth)

8139 HISTOCHEMICAL AND CYTOLOGICAL STUDIES OF THE EARLY CHANGES IN THE BONES DUE TO Sr^{90}. N. N. Kurshakova and A. S. Petrova. Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 915-17(Aug. 1963).

Histochemical and cytological study was done of the early changes (preceding malignant growth) in the bones of rats to which Sr^{90} was injected intraperitoneally in a dose of 0.4 mC/kg of body weight. Prior to the appearance of morphological osteosarcoma signs, as well as in the developed tumors, cells revealed atypical shape and a high activity of alkaline phosphatase. The presence of such cells in the bone tissue in the absence of any visible signs of malignant growth may serve as an early indication of the beginning tumor growth in the bones. (auth)

8140 DEPRESSION OF THE FUNCTIONING OF THE PHYSIOLOGICAL ANTICOAGULATORY SYSTEM IN EXPERIMENTAL RADIATION SICKNESS OF ANIMALS. V. E. Pastorova and B. A. Kudryashov (Moscow Univ.). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 974-6(Nov. 1963).

Experiments performed on rats demonstrated x-irradiation (600 r) depressed the physiological anticoagulative system. Intravenous administration of thrombin solution (in sufficiently strong concentration) to the irradiated animals caused immediate death from cardiac vessel and vascular thrombosis; this was distinct from normal animals, which being in the same conditions, remained alive. Intravenous injection of thrombin in low doses failed to cause the death of irradiated animals, nor did it provoke protective reaction of the blood fibrinolytic system, but led to a more gradual change of the plasma tolerance of heparin. In 6 to 10 minutes after thrombin administration (in the same doses) to control animals there was a rise of the blood fibrinolytic activity and a considerable reduction of plasma tolerance to heparin. The data point to the depression occurring in the humoral part of the physiological anticoagulative system in the irradiated animals. (auth)

8141 THE LEUKOCYTIC REACTIONS OF IRRADIATED MICE TO TRANSFUSION WITH HETEROLOGOUS BLOOD. R. F. Yurin (Lenin Medical Inst., Moscow). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 994-7 (Nov. 1963).

Heterologous blood was transfused to intact and previously irradiated rats, the periods between irradiation and transfusion being 6 hours, 3 days, 4 and 8 weeks. For 6 hours after the transfusion a study was made of the dynamic reaction of leukocytes, neutrophiles, and lymphocytes in the peripheral blood of these animals. Some post-irradiation peculiarities attending posttransfusional acute leukocytic reactions were revealed. (auth)

8142 THE REACTION OF THE CORNEAL EPITHELIUM TO LOCAL IRRADIATION WITH VARIOUS DOSES OF SOFT X-RAYS. V. M. Mastryukova and A. D. Strzhizhovskii. Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 1161-3(Nov. 1963).

An inquiry was made into the changes occurring in the corneal epithelium of albino mice following soft x irradiation in doses of 100, 700, and 2000 r. These x ray doses depressed the mitotic activity, caused the appearance of pathological mitosis and reduction of the number of cells per unit of corneal area. The affection of the mitotic apparatus, underlying pathological mitosis, blocked irreversibly the passing of the cell through mitotic stages. Of the doses investigated only 2000 r caused a direct radiation destruction of the cell. (auth)

8143 CONNECTION BETWEEN THE INCREASED FIBRINOGEN CONCENTRATION IN DOGS WITH RADIATION SICKNESS AND THE FIBRINOGENASE ACTIVITY. K. V. Gordeeva (Kirov Military Medical Academy, Leningrad). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 1221-3(Nov. 1963).

A study was made of the concentration of blood plasma fibrinogen in relation to the changes of fibrinogenase activity. Dogs with radiation sickness (severe, moderately severe, and mild) served as experimental animals. A rise of the blood plasma fibrinogen content was observed in dogs with severe and moderately severe radiation sickness. This phenomenon is especially pronounced at the height of radiation sickness. The activity of fibrinogenase in severe radiation sickness was considerably decreased at the initial period and at the height of the disease. The rise of fibrinogen content in severe and moderately severe radiation sickness should be regarded as an adaptive reac-

tion directed to control hemorrhages, not as the sequence of reduced fibrinogenase activity. (auth)

8144 INVESTIGATION OF LOCAL RADIATION INJURIES IN DNA BY THE METHOD OF THERMAL SEPARATION OF SPIRALS. N. I. Ryabchenko, P. I. Tseitlin, and A. G. Yaskevich (Inst. of Experimental Biology and Inst. of Medical Radiology, Moscow). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 1232-5(Nov. 1963).

By the method of thermal separation of strands a study was made of the local injuries in the DNA macromolecule caused by x and uv irradiation. By analysis of the degradation kinetics and flexibility of the initial and final products it was shown that x irradiation causes no cross linking preventing the separation of DNA strands; at the same time irradiation leads to the appearance of breaks in polynucleotide chains. In ultraviolet irradiation, thermostable cross-linking was formed, preventing the separation of the two-stranded structure. (auth)

8145 A GENERAL TARGET THEORY OF RADIOBIOLOGICAL ACTION. Arthur Bierman (Lockheed-California Co., Burbank, Calif.). Bull. Math. Biophys., 25: 273-96 (Sept. 1963).

New distribution functions are developed within the framework of target theory that take account of the track nature of ionizing particles and of possible memory effects as well as possible repair of hits. These functions differ from the Poisson distribution when applied to multihit systems. Various consequences are examined. In particular, methods are suggested for determining the hit multiplicity of a target system, and the value of the repair constant in case hits is repairable. The distribution functions also indicate a linear relation between the logarithm of the surviving fraction and the dosage for small dosage. (auth)

8146 LAG PHASE OF ESCHERICHIA COLI AS INFLUENCED BY X-RAYS, TEMPERATURE AND NUTRIENT. M. O'Dile Cahoon, G. M. Clark, and D. G. Baker (Univ. of Toronto). Can. J. Genet. Cytol., 5: 472-81(Dec. 1963).

Escherichia coli, following x irradiation, showed a prolonged lag phase of the growth curve. The logarithmic phase, once initiated, was not different from that of non-irradiated cells. The length of the increased lag phase following irradiation was dose dependent. When post-irradiation incubation temperature was 15°C for 22 hours, the lag was not increased as much as it had been with immediate 37°C incubation. This shortening effect was not observed when cells were maintained without glucose for the 15°C period of 22 hours. Cells treated with 15°C, with or without glucose, showed a marked dose-rate dependence in terms of length of increased lag, an intermediate dose-rate causing the longest lag. Colonies of Escherichia coli growing on nutrient agar following irradiation exhibited a slower growth than did colonies from non-irradiated cells. The retardation of growth was dose-dependent. (auth)

8147 CELL-FREE TRANSMISSION OF RADIOGENIC MYELOID LEUKEMIA IN THE MOUSE. V. K. Jenkins and A. C. Upton (Oak Ridge National Lab., Tenn.). Cancer Res., 23: 1748-55(Dec. 1963).

Radiogenic myeloid leukemia of the RF mouse was passaged in unirradiated newborn and adult recipients of the same strain by intravenous inoculation of leukemic spleen cell suspensions, cell-free filtrates of such suspensions, and centrifuged (presumably cell-free) spleen extracts and blood plasma. The incidence of leukemia in inoculated mice increased on successive passages, and the induction period decreased. After the fifteenth passage, supernatant fluid from centrifuged (30,000 × g for 60 min) leukemic spleen cell suspension and blood plasma transmitted the disease within 70 days to 30 to 60% of unirradiated adult recipients. Although the leukemia retained its granulocytic and myelocytic character on serial transmission in adults, a significant number of newborn recipients developed thymic lymphomas within 90 days after inoculation, suggesting either that the same agent can induce both types of leukemia, depending on the influence of host factors, or that more than one leukemogenic agent was present in our filtrates. Leukemogenic activity was not detected in filtrates of brain or spleen tissue from donors with primary radiogenic myeloid leukemia on inoculation into unirradiated recipients or those given 150 to 300 r of whole-body x rays; however, such filtrates increased the incidence of myeloid leukemia on inoculation into mice previously exposed to 450 r whole-body x radiation, suggesting that radiation may enhance susceptibility to an agent present in otherwise undetectable amounts or form. The relatively short latency of the filtrate-induced leukemia (less than 6 weeks) contrasted sharply with the characteristically long latency of the radiation-induced leukemia (6 to 50 weeks), from which it may be inferred that the leukemogenic action of radiation is not merely the prompt activation or liberation of latent leukemia virus. (auth)

8148 INDUCTION OF NEOPLASMS IN THYROID GLANDS OF RATS BY SUBTOTAL THYROIDECTOMY AND BY THE INJECTION OF ONE MICROCURIE OF I^{131}. Robert C. Goldberg, S. Lindsay, C. W. Nichols, Jr., and I. L. Chaikoff (Univ. of California, Berkeley and San Francisco). Cancer Res., 24: 35-43(Jan. 1964).

Female Long-Evans rats were subjected to subtotal thyroidectomy, subtotal thyroidectomy plus injection of 1 μc of I^{131}, subtotal thyroidectomy plus injection of 1 μc of I^{131} plus feeding of a diet containing desiccated thyroid, subtotal thyroidectomy plus feeding of a diet containing desiccated thyroid, injection of 1 μc of I^{131}, feeding of a diet containing desiccated thyroid, and injection of 1 μc of I^{131} plus feeding of a diet containing desiccated thyroid. Single and multiple adenomas were found in rats subjected to subtotal thyroidectomy and in those subtotally thyroidectomized and given injections of 1 μc of I^{131}. In rats subjected to these same treatments but, in addition, fed the thyroid-containing diet, significantly fewer adenomas were encountered. Four papillary carcinomas and one follicular carcinoma were found in rats subjected to subtotal thyroidectomy and/or given injections of 1 μc I^{131}. No carcinoma was observed in control rats. Two papillary carcinomas were found in glands following subtotal thyroidectomy alone, a finding suggesting that thyrotropic hormone stimulation may cause the development of both benign and malignant thyroid neoplasms. One papillary and one follicular carcinoma developed in the intact thyroid glands of rats that received only 1 μc of I^{131}. These malignant neoplasms were possibly induced solely by the I^{131} irradiation. One papillary carcinoma developed in a rat that had been subjected to subtotal thyroidectomy, given an injection of 1 μc of I^{131}, and fed the desiccated thyroid-containing diet. This neoplasm appeared to be the result of either prolonged thyrotropic hormone stimulation or I^{131} irradiation. (auth)

8149 SPONTANEOUS CHROMOSOMAL INJURIES OF EMBRYONIC HUMAN FIBROBLASTS IN VIVO AND IN VITRO. A. A. Prokofeva-Belgovskaya and I. V. Veshneva (Inst. of Biological Physics, Academy of Sciences, USSR).

Dokl. Akad. Nauk SSSR, 153: 457-9(Nov. 11, 1963). (In Russian)

Five human embryos 1.5 to 2 months old were used in order to determine the spontaneous mutation rate in man by counting the chromosomal aberrations. A primary cell culture of the embryonic fibroblasts was also used to determine the gamma radiation dose required to double the spontaneous mutation rate in man. The chromosomal aberrations were counted during anaphase and telophase. The spontaneous mutation rate varied from almost zero for embryo No. 4 to 0.56% for embryo No. 3 with an average of 0.28% for the five embryos. The spontaneous mutation rate in vitro was higher by a factor of 6 than the mutation rate in vivo, and varied from 1.3 to 2.0% with an average of 1.6%. The average dose doubling the natural mutation rate in embryonic human fibroblasts varied from 1.3 to 2.1 r in vivo, and from 7.2 to 12.3 r in vitro. (TTT)

8150 A NEW METHOD TO EVALUATE THE BIOLOGICAL EFFECT OF RADIATION IN TISSUE CULTURE. P. Verani, D. Balducci, and M. Chiozzotto (Istituto Superiore di Sanita, Rome). Exptl. Cell Res., 32: 333-41(Nov. 1963).

Cultures of primary kidney cells from monkey (M. rhesus) were found to be an ideal material for radiation studies. They are formed by a homogeneous cell population identical in each laboratory and derived from the animal which is closest to man in the zoological scale. After x irradiation, using 300, 600, 1000, 1500, and 3000 r, the cells undergo a series of morphological alterations, the most important of which is the appearance of a high proportion of polynucleated cells with micronuclei. The number of such cells and the number of micronuclei are proportional to the irradiation dose when 1500 r are not surpassed. By increasing the dosage, a paradoxical effect occurs, due to the dispersion of dead cells in the medium fluid. The method has practical applications. (auth)

8151 THE EFFECT OF X-RADIATION ON NUCLEAR HISTONE CONTENT. N. R. Ringertz (Karolinska Institutet, Stockholm). Exptl. Cell Res., 32: 401-4(Nov. 1963).

The effects of 1200 r of x radiation on nuclear histone and DNA content of Ehrlich tumor cells exposed in vivo were determined by a cytochemical method involving differential staining. Data are presented on the histone and DNA content for irradiated and nonirradiated premitotic tetraploid cells as compared with the histone and DNA content of diploid cells. (C.H.)

8152 EFFECT OF X-RAY ON DNA SYNTHESIS AND MITOSIS IN CERVICAL CANCER. Ruth M. Graham (Roswell Park Memorial Inst., Buffalo). Exptl. Cell Res., Suppl., No. 9, 559-62(1963).

Wide variations were found in the radiosensitivity of cells from cervical tumors from patients undergoing x radiation therapy. No evidence was found of disturbances in DNA synthesis or cell division in radioresistant cells. Differential counting of benign cells in vaginal cells before treatment gave an indication of the condition of benign tissue surrounding the tumor. The presence of large numbers of histocytes was interpreted as a host response to the cancer. The presence of these cells was correlated with the survival of patients with cancer of the cervix treated by radiotherapy. The greater the histocytic response before treatment, the higher the survival at two years. It is suggested that the sensitivity of a tumor to radiation is dependent on the reaction of the host to the tumor before treatment is initiated. (C.H.)

8153 SOME SPECIAL EFFECTS OF IONIZING RADIATION. P. C. Koller (Royal Cancer Hospital, London). Exptl. Cell Res., Suppl., No. 9, 563-6(1963).

Factors causing a difference in the response of tumor cells to identical doses of ionizing radiation are discussed. The effects of growth rate of the tumor, the relation between chromosome number and radiosensitivity, and the influence of host environment on tumor cells exposed to radiation are considered. (C.H.)

8154 GENETIC RADIOSENSITIVITY OF SPECIFIC POST-DICTYATE STAGES IN MOUSE OÖCYTES. R. G. Edwards and A. G. Searle (National Inst. for Medical Research, London and Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Genet. Res., 4: 389-98(Nov. 1963).

The induction of dominant lethals after x irradiation of dictyate, later meiotic stages, and the pronuclear stage after fertilization was compared using the technique of induced ovulation in mice. The injection of gonadotrophins ensures that the time at which the synchronously dividing oöcytes reach any particular meiotic stage is accurately known. Embryonic lethality up to 13.5 days was studied after 0, 100, and 200 r acute x irradiation. Metaphase I, anaphase I and metaphase II were the most sensitive stages, with LD_{50}'s of about 120, 130, and 170 r respectively. The dictyate and pronuclear stages were much less sensitive, with LD_{50}'s in the region of 500 r, and sensitivity rose steeply during prophase I. Numbers of corpora lutea decreased with irradiation, the decrease being greatest with irradiation at metaphase I and anaphase I. The ovulation of large numbers of eggs, which increased the preimplantation loss of embryos above normal, and the low luteal counts probably masked lethality to some extent. Results generally agree well with those reported in a number of plant and animal species. (auth)

8155 HETEROGENEITY AMONG SPERMATOGONIA OF DROSOPHILA MELANOGASTER IN SENSITIVITY TO X-RAYS. H. Slizynska (Inst. of Animal Genetics, Edinburgh). Genet. Res., 4: 446-56(Nov. 1963).

Sensitivity of Drosophila melanogaster male germ-cells to chromosome breakage by x rays was measured by the structural changes found in the salivary gland chromosomes of larvae from irradiated fathers and untreated mothers. The genetical effectiveness of irradiation on the same males was measured by the frequency of sex-linked lethals. Assessed by the overall percentage of germ-cells carrying structural changes, sensitivity follows the well-known pattern: it is highest in spermatids and decreases over spermatozoa and spermatocytes to spermatogonia. This overall sensitivity was analyzed on three levels. The fact that the sensitivity of spermatogonia varies both between and within individual males was tentatively attributed to the presence or absence of spermatogonial mitoses. (auth)

8156 A TEST FOR X-RAY INDUCED TRANSLOCATIONS IN SPERMATOGONIA OF DROSOPHILA MELANOGASTER. J. C. McCarthy and H. Nafei (Inst. of Animal Genetics, Edinburgh). Genet. Res., 4: 485-6(Nov. 1963).

The frequency of genetically detectable translocations was determined in spermatozoa, spermatocytes, and early and late spermatogonia in irradiated male Drosophila melanogaster. The males were exposed to 3000 r of x radiation and mated to 3 types of tester females. Results are presented in tabular form. (C.H.)

8157 DOSE RATE EFFECTS IN THE DEVELOPING GERM CELLS OF MALE DROSOPHILA. Mary L. Alexander and Janet Bergendahl (Univ. of Texas M. D. Anderson Hospital, Houston and Univ. of Texas, Austin). Genetic 49: 1-16(Jan. 1964).

The developing germ cells of Drosophila melanogaster were treated with fast and fractionated doses of x radiation in 4 atmospheres of argon or in 3 atmospheres of argon + 2 atmospheres of oxygen. An enhancement in biological damage was observed in all postmeiotic sperm and spermatid cells in tests when oxygen was present in combination with argon. There were no effects due to the rate at which the radiation was administered with mature sperm cells. Enhancements in translocations and sex-linked recessive lethals were obtained for spermatids in argon by giving the total radiation dose in two fractions 40 minutes apart. When oxygen was present with the argon, similar values were obtained with a fast, continuous dose and with fractionated doses. Another type of dose rate effect was observed when spermatogonia were treated. The dominant lethal percentages were higher when doses were fractionated in both the argon and in the argon + oxygen tests. (auth)

8158 INFLUENCE OF DNA SYNTHESIS ON THE PRODUCTION OF CHROMATID ABERRATIONS BY X RAYS AND MALEIC HYDRAZIDE IN VICIA FABA. H. J. Evans and D. Scott (Medical Research Council Radiobiological Research Unit, Harwell, Berks, Eng.). Genetics, 49: 17-38(Jan. 1964).

Using H^3-thymidine as a marker for DNA synthesis, and autoradiographic techniques, the average durations of the various parameters of the mitotic cycle in Vicia roots were determined as follows: presynthesis phase (G_1) 4.9 hr, DNA synthesis phase (S) 7.5 hr, postsynthesis phase (G_2) 4.9 hr, and mitosis (M) 2 hr. The duration of these phases and their sensitivity to the production of chromosome aberrations following x ray or maleic hydrazide (MH) treatment was then studied in experiments using combined treatments with these agents and with H^3-thymidine. Cells exposed to 100 rads of x rays whilst in G_2 were delayed in development and contained chromatid-type aberrations. The aberration yield was highest in cells exposed whilst in mid-G_2, cells in late S and early and late G_2 being less sensitive. In contrast with the x ray results, with MH it was found that G_2 cells were not delayed in their development to the first mitosis and did not contain any aberrations. However, these cells contained chromatid-type aberrations when observed at the second posttreatment mitosis. Cells exposed to MH whilst in the S phase were considerably retarded in development and carried chromatid-type aberrations at the first and later posttreatment mitoses. The yield of aberrations in these cells was found to be directly correlated with the amount and rate of DNA synthesis occurring during exposure. No chromosome-type aberrations were induced by MH; cells in G_1 were sensitive but contained only chromatid-type changes. It was concluded that the aberrations induced by MH are consequences of errors in chromosome duplication occurring only during the DNA synthesis phase, and possible mechanisms of action are discussed. Comparisons were made between the relative frequencies of the various chromatid aberration types after x rays and MH and it was concluded that the reduced frequency of translocation following chemical treatment was a consequence of the dependence of aberration formation on duplication. The absence of chromosome-type breaks and delayed production of aberrations with MH in Vicia parallels some of the effects of other chemical agents which produce structural changes and mutations in Drosophila. These parallels are discussed, particularly with reference to the production of mosaic individuals. (auth)

8159 COMPARATIVE EARLY AND LATE EFFECTS OF SINGLE AND PROLONGED EXPOSURE TO RADIOIODINE IN YOUNG AND ADULTS OF VARIOUS ANIMAL SPECIES. A REVIEW. R. J. Garner (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). Health Phys., 9: 1333-9(Dec. 1963).

A review is presented on the biological effects of I^{131} in the sheep, pig, cow, and domestic fowl. Adult animals given large amounts of I^{131} over a short or prolonged period develop the typical signs of hypothyroidism. Lactation is depressed but neither wool growth nor fertility is affected. Sheep become susceptible to respiratory infection and commonly die from pneumonia; experimental cows manifest complications following parturition, requiring sacrifice. The offspring of animals exposed when nonpregnant appear to be normal, but young exposed in utero to high doses are born dead or do not develop normally. The blood chemistry follows the general pattern observed after surgical thyroidectomy. The thyroid of the cow and chick is less sensitive than that of the sheep. (P.C.H.)

8160 EFFECT OF I^{131} ON REPRODUCTIVE PERFORMANCE IN EWES. H. A. Ragan, W. J. Clarke, R. O. McClellan, V. G. Horstman, and L. K. Bustad (General Electric Co., Richland, Wash.). Health Phys., 9: 1343-7 (Dec. 1963).

The reproductive performance of seventeen ewes fed single doses of 3 mC I^{131} 4-5 years ago was evaluated. The performance of the hypothyroid animals was compared with that of a group of euthyroid ewes of the same age kept under identical conditions. The estrus cycles, times in estrus during a 60-day period, and gestation periods of the hypothyroid ewes were not significantly different from those of the controls; however, there was greater variation within the hypothyroid group. The serum protein-bound iodine (PBI) values, determined prior to breeding and at intervals throughout and following the gestation period, indicated a slight rise at 50–100 days of pregnancy in both the experimental and control group. All of the control ewes (six/six) conceived after the first mating. Three of seventeen hypothyroid ewes failed to conceive or experienced early embryonic death, two of these three ewes manifested signs of estrus at regular intervals. Thyroid uptake of an I^{131} tracer dose in the hypothyroid ewes ranged from 5.6–20% in those that were pregnant and 3–11% in those that were not pregnant. The two ewes with the lowest thyroid I^{131} tracer uptake (5.6 and 6%) died during the course of pregnancy. There were no cases of spontaneous abortion or still births in either the hypo- or euthyroid groups. The lambs from the hypothyroid group did not gain weight as rapidly during the first month of life and their PBI values at birth were lower than those of the control lambs. (auth)

8161 EFFECTS INCLUDING CARCINOGENESIS OF I^{131} AND X-RAYS ON THE THYROID OF EXPERIMENTAL ANIMALS: A REVIEW. I. Doniach (London Hospital). Health Phys., 9: 1357-62(Dec. 1963).

A review is presented on the effects of I^{131} and x radiation on the thyroid function and the carcinogenic action of I^{131} and x radiation on the thyroid gland in experimental animals. A similarity of biological action of x rays and I^{131} on the thyroid was noted. A dose of 1000 rad of x rays has a similar quantitative effect to a calculated mean dose

of about 10000 rad from I^{131} for the inhibition of goitrogenesis, adenoma and carcinoma induction, and carcinomatous summation with prolonged goitrogen treatment. (P.C.H.)

8162 COMPARATIVE EFFECTS OF I^{131} AND X-IRRADIATION ON SHEEP THYROIDS. R. O. McClellan, W. J. Clarke, H. A. Ragan, D. H. Wood, and L. K. Bustad (General Electric Co., Richland, Wash.). Health Phys., 9: 1363-8(Dec. 1963). (HW-SA-3076)

A preliminary study to determine the early comparative effects of I^{131} and x irradiation on the thyroid was performed in young adult sheep. The thyroid region of one group of animals was exposed to x irradiation, with doses of 750–4500 r given as single or three exposures at weekly intervals. Other animals were given single oral doses of 1.25–5.0 mC I^{131} with estimated average thyroid radiation doses of 24000–90000 rad. Only minimal changes in thyroid function were observed, as evaluated by radioiodine uptake and determination of serum protein-bound iodine. Histopathological changes including inflammation, necrosis, and fibrosis of the thyroid were observed in the exposed animals and were generally dose dependent. In the x irradiated animals, tissue damage was observed in the structures contiguous to the thyroid gland. (auth)

8163 CARCINOGENIC EFFECTS OF I^{131} COMPARED WITH X-IRRADIATION. A REVIEW. E. L. Saenger, R. A. Seltzer, T. D. Sterling, and J. G. Kereiakes (Univ. of Cincinnati and Public Health Service, Cincinnati). Health Phys., 9: 1371-84(Dec. 1963).

A review is presented on various studies concerned with the induction of thyroid cancer following irradiation. Certain concepts concerning the relative carcinogenic effects of I^{131} versus external x and gamma radiation are also presented. The association of irradiation and thyroid cancer in humans is discussed at length. It was concluded that in adults with large x-ray doses (2000-6000 r) delivered to the thyroid gland, carcinoma may develop rarely after a latent period of 10–35 years. It is probable that doses of 100 r or greater of external x ray delivered to the thyroid of children will cause an increase in the incidence of carcinoma. However, proof of a cause and effect relation is lacking. It seems reasonable on the basis of present information that the difference in neoplastic response of I^{131} as compared to x or gamma irradiation is primarily a function of differences of dose rates and tissue distribution. (P.C.H.)

8164 THE RELATION BETWEEN DNA SYNTHESIS AND CHROMOSOME STRUCTURE AS RESOLVED BY X-RAY DAMAGE. H. J. Evans and J. R. K. Savage (Medical Research Council, Harwell, Berks, Eng.). J. Cell. Biol., 18: 525-40(Sept. 1963).

Vicia faba root tip cells were treated for short periods with tritiated thymidine, either immediately before or after exposure of roots to x rays, and autoradiograph preparations were analyzed in an attempt to test the hypothesis that chromatid type (B′) aberrations are induced only in those chromosome regions that have synthesized DNA prior to x irradiation, whereas chromosome type (B″) aberrations are induced only in unduplicated chromosome regions. Studying the relation between presence or absence of label at loci involved in aberrations, in cells irradiated at different development stages, and the pattern of labeling in cells carrying both types of aberration leads to the conclusion that B″ aberrations are induced only in unreplicated chromosome regions. Following replication, only B′ aberrations are induced, but these aberrations are also induced in chromosome regions preparing to incorporate DNA. It is suggested that the doubled response of the chromosome to x rays prior to DNA incorporation might reflect a physical separation of replicating units prior to replication. The aberration yields in damaged cells that were irradiated in G_1, S, and early G_2 were in the ratio of 1.0:2.0:3.2. The data indicate that the increased yield of B′ in early G_2 relative to S cells may be a consequence of changes in the spatial distribution of the chromosomes within the nucleus. (auth)

8165 GONADOTROPHIC RESPONSE OF THE OVARIES OF THE ALBINO MOUSE FOLLOWING CHRONIC LOW-INTENSITY GAMMA IRRADIATION. J. D. Hunter and George M. Krise (Texas Agricultural and Mechanical Coll., College Station). J. Endocrinol., 27: 77-86(1963).

Immature female albino mice were exposed to Co^{60} irradiation at rates of 20 r and 40 r/day to total doses of 250, 500, 750, and 1000 r. Those irradiated at 40 r/day during the 1st week of life showed only one-third of the normal increase in uterine and ovarian weight after injection of human chorionic gonadotrophin (HCG) when 25 days old. No further decline in response was seen when the total dose was increased from 250 to 1000 r. Irradiation at 20 r/day to total doses of 500 r produced little change in normal HCG response. In contrast, sexually mature adults exposed at 40 r/day to total doses of 1000 r showed little response to HCG. Histological examination of ovaries from immature mice exposed to doses of 250, 500, and 1000 r at 40 r/day revealed a depopulation of primary oocytes and early maturing follicles as well as a notable decrease in ovarian size. (auth)

8166 CHANGES IN THE SULFHYDRYL AND DISULFIDE GROUPS IN ANIMAL SKIN FOLLOWING A SINGLE EXPOSURE TO ULTRAVIOLET LIGHT. Masakazu Kusuhara and John M. Knox (Baylor Univ., Houston, Tex.). J. Invest. Dermatol., 39: 287-93(Oct. 1962).

The effects of ultraviolet irradiation on the sulfhydryl and disulfide concentration in rat epidermis was studied after determining the optimal method for removing hair and a satisfactory method for separating the epidermis from dermis. A single intense exposure to ultraviolet light produced an increase in both the –SH and S–S concentration in one hour. After 24 hours the –SH values were still increased but S–S had dropped to a below-normal range. At three days post-radiation, the –SH concentration had become lower than normal and the S–S concentration was now higher than normal. By six to ten days post-radiation the –SH and S–S values approached normal. An oxidation-reduction phenomenon of S–S to –SH and vice-versa does not adequately explain the variations in concentrations since there is an initial increase in both values and because of the wide separation in absolute values of S–S and –SH. (auth)

8167 SUNLIGHT AS A FACTOR INFLUENCING THE THICKNESS OF EPIDERMIS. Robert G. Freeman, Earl G. Cockerell, Jim Armstrong, and John M. Knox (Baylor Univ., Houston, Tex.). J. Invest. Dermatol., 39: 295-8(Oct. 1962).

Measurements of epidermal thickness were made on 28 human volunteers. Shortening of rete ridges was found in exposed white skin but was not seen in unexposed skin nor in Negroes. Differences in epidermal thickness related to age, sex, complexion, or variation in sunlight exposure were not statistically significant. (P.C.H.)

8168 A POLAROGRAPHIC STUDY ON THE EFFECTS OF ULTRAVIOLET LIGHT ON SCALES, EPIDERMIS, DERMIS, AND SERUM. Ryohei Ogura, John M. Knox,

and Masakazu Kusuhara (Kurume Univ., Japan and Baylor Univ., Houston, Tex.). J. Invest. Dermatol., 40: 37-43 (Jan. 1963).

The effects of ultraviolet irradiation on the protein of powdered scale, epidermis, and dermis and on serum protein was studied by employing a polarographic technic. Scales, serum, and dermis showed striking alterations. Epidermis manifested noteworthy stability; no significant changes were found following intensive ultraviolet irradiation. It is possible that although only a small percentage of the ultraviolet from sunlight reaches the dermis, it is in this area that the most significant biological changes occur. (auth)

8169 RADIATION-INDUCED OSTEOGENIC SARCOMA IN PARABIONT RATS. S. Warren and R. N. Chute (New England Deaconess Hospital, Boston). Lab. Invest., 12: 1041-5(Nov. 1963). (TID-18787)

Studies were made on the development of osteogenic sarcomas in irradiated rats. Parabiosis and shielding of one partner permitted the other to survive a supralethal single dose of 1000 r of whole body x irradiation and to live to develop late complications. Parabiosis increased the incidence of osteogenic sarcoma in rats. Parabiosis and external whole-body radiation produced osteogenic sarcomas, sometimes multiple, in about 5% of the rats. Most osteogenic sarcomas produced were endosteal in origin. Osteogenic sarcomas varied widely in individually averaged increments of diameter, from 1.1 to 0.07 mm per day. Abnormalities of parathyroid glands were present but did not correlate with occurrence of osteogenic sarcomas. (P.C.H.)

8170 EFFECT OF GAMMA-RADIATION ON EGGS OF THE SILKWORM. T. J. Henneberry and W. N. Sullivan (Dept. of Agriculture, Beltsville, Md.). Nature, 200: 1121-2(Dec. 14, 1963).

Results are reported from studies of the effects of single and fractionated doses of γ radiation on the development of silkworm eggs exposed during various developmental stages. Dosage-mortality curves are presented for 1, 4, and 7 days post-irradiation. It is suggested that eggs of the silkworm (Bombyx mori) are a suitable organism for use in space studies to record accurately the effects of cosmic and other radiations on biological materials. They are extremely light in weight, require no food or water, require only minute amounts of oxygen, the genetic characteristics are well-documented, the eggs are laid in a solid single layer, and their large size makes them suitable targets for hits from heavy nuclei of primary cosmic radiation. (C.H.)

8171 FALSE POSITIVE DIRECT COOMBS TESTS FOLLOWING TOTAL-BODY X-IRRADIATION OF MICE. Oscar Garfein, Nancy Treacy, and John G. Gorman (Columbia Univ., New York and Presbyterian Hospital, New York). Nature, 200: 1168-70(Dec. 21, 1963).

To test the hypothesis that natural tolerance to autoantigens may be destroyed by x rays, mice were irradiated with 400 or 500 r whole-body x-ray exposures on various dose schedules, and serial blood samples were examined with a direct Coombs test, looking for an auto-immunization to red blood-cell antigens. Appreciable fractions (25 to 86%) of the irradiated mice gave positive direct Coombs tests, but a small fraction (15%) of the unirradiated control mice also gave positive tests. Subsequent experiments showed that the positive tests were false, being due to reticulocytosis of phenylhydrazine and not to breakdown of natural tolerance. The probable reactions are discussed. (D.L.C.)

8172 BONE-MARROW MITOTIC INHIBITION INDUCED BY LOCAL SPLENIC X-IRRADIATION. P. A. Maurice and A. Jeanrenaud (University Hospital, Geneva). Nature, 200: 1221-2(Dec. 21, 1963).

X-irradiations were carried out on surgically exteriorized spleens of lead-shielded rabbits, and the resulting hematological changes were studied in the blood and bone marrow. The results show that 48 to 66 hr after 300 r x-irradiation of the spleens, reticulocytopenia results, indicating erythropoietic inhibition. Bone-marrow activity also decreases 20 hr after splenic irradiation, and the post-irradiation mitotic index is 45% lower than the pre-irradiation index. Similar experiments on splenectomized rabbits did not show any such changes. Experiments utilizing splenectomies at different intervals after splenic irradiation showed that only the animals with intact spleens at least 2 hr after irradiation showed erythropoietic inhibition. The isolation of an antimitotic factor from irradiated spleens is reported. (D.L.C.)

8173 EFFECT OF THE PRE-OPERATIVE IRRADIATION AND SUBCUTANEOUSLY CANCER TISSUE IMPLANTATION ON THE ANTITUMOR ANTIBODY LEVELS REPORT. [PART] II. Jun Makidono (Clinic of Radiological Research Inst., Hiroshima). Nippon Igaku Hoshasen Gakkai Zasshi, 23: 574-8(Aug. 1963).

In part I, it was shown that tumor-bearing individuals could be placed in an anticancer state by creation of autoantigens by cancer cells destroyed by irradiation. In part II, the same fact is reconfirmed by 13 additional cases conducted later. It is concluded that the preoperative irradiation makes possible the creation of antitumor antibodies, since the antibodies were not found in nonirradiated tumor-bearing individuals. (TCO)

8174 INFLUENCE OF TOTAL-BODY X-IRRADIATION ON NUCLEOSIDE PHOSPHORYLASE IN RAT ERYTHROCYTES. Donald A. Rappoport and Richard R. Fritz (Univ. of Texas, Galveston). Radiation Res., 21: 5-15(Jan. 1964).

Single-dose whole-body irradiation of rats with 100 to 1000 r inhibited erythrocyte nucleoside phosphorylase from 28 to 77% at 96 hours postirradiation. Subsequently, complete recovery of enzyme activity was observed in erythrocytes from rats exposed to 100, 250, and 500 r of x rays, partial recovery of activity after 750 r, and no recovery after 1000 r. Erythrocytes from young rats contained a higher activity of nucleoside phosphorylase, but the inhibition of enzyme activity after whole-body x irradiation was the same as in the older rat erythrocytes when compared on a per cent basis. (auth)

8175 DIRECT AND INDIRECT INACTIVATION OF BACTERIOPHAGE T6 CONTAINING HALOGENATED DNA. Hiroshi Tanooka (Univ. of Rochester, N. Y.). Radiation Res., 21: 26-35(Jan. 1964).

In broth, the x-ray sensitivity of the bacteriophage T6 was doubled when 5-bromodeoxyuridine or 5-iododeoxyuridine (BUDR or IUDR) was incorporated. In an aqueous suspension, the immediate and delayed inactivation of phage by x irradiation did not show a significant difference between control, BUDR-incorporated, and IUDR-incorporated phage. This finding supports the view that the phage DNA is a principal target of the direct action of ionizing radiation, whereas the outer coat of the phage is a principal target of the indirect action. X irradiation of aqueous solutions of the critical molecules thymidine, BUDR, and IUDR showed the same degree of optical density decrease with increasing x-ray dose. This indicates that the ring struc-

tures of thymidine, BUDR, and IUDR are equally sensitive to radical attack. (auth)

8176 EFFECTS OF TOTAL-BODY X-IRRADIATION ON PHOSPHATE ESTERIFICATION AND HYDROLYSIS IN MITOCHONDRIAL PREPARATIONS OF RAT SPLEEN. John F. Thomson (Argonne National Lab., Ill.). Radiation Res., 21: 46-60(Jan. 1964).

Mitochondria that will esterify inorganic phosphate with high efficiency can be prepared from rat spleen. When mitochondria are prepared from spleens of x-irradiated rats (4 hours after 1000 r), no effect on oxidative phosphorylation is apparent. Under experimental conditions that are unfavorable for efficient phosphorylation, such as suboptimal concentration of cytochrome c, the effect of radiation is manifested by further impairment. The data indicate, however, that the impairment is the result of a change in the composition of the mitochondrial preparation, subsequent to a shift in the distribution of cell populations in the irradiated spleen. Consequently, the mitochondrial preparations from tissues of irradiated rats contain larger amounts of phosphatases, the effect of which will be to catalyze the hydrolysis of organic phosphates, notably ADP and ATP, unless their concentrations are kept low by maintenance of efficient phosphorylation and trapping. The activity of the phosphatases is not completely suppressed by the presence of fluoride. (auth)

8177 STUDIES ON THE EFFECTS OF COBALT-60 GAMMA RAYS ON PROTAMINE SULFATE, LYSOZYME AND INSULIN BY USING MONOLAYER TECHNIQUE. Anasuya M. Desai and K. S. Korgaonkar (Indian Cancer Research Center, Bombay). Radiation Res., 21: 61-74 (Jan. 1964).

The monolayer properties of protamine sulfate, lysozyme, and insulin before and after their irradiation in dilute aqueous solution were studied with a Langmuir-Adam type of trough-and-float system and a torsion balance. The monolayers of all three proteins from the irradiated samples show increase in compressibility and expanded character in the pressure region below about 1 dyne/cm. Significant changes were also noted in the molecular weights, in the total and actual areas occupied by the molecules, and in the area compressibility of the monolayers. The plateau-like regions in the P–A curves of both protamine sulfate and lysozyme show a tendency to fade out on irradiation. Many of the observed irradiation effects are indicative of the drastic reduction in the polar groups of the molecules and an attack on the aromatic rings, particularly at higher doses. (auth)

8178 THE LETHAL EFFECTS OF PULSED NEUTRON OR GAMMA IRRADIATION IN MICE. E. J. Ainsworth, G. F. Leong, K. Kendall, and E. L. Alpen (Naval Radiological Defense Lab., San Francisco). Radiation Res., 21: 75-85(Jan. 1964).

The relative potencies of high-dose-rate pulsed radiation exposures as compared to radiation exposures of several minutes' duration on the acute mortality responses of mice exposed to neutrons or gamma rays were investigated. The results indicate no significant differences as a function of radiation dose rate within either the neutron irradiated or gamma irradiated groups in terms of $LD_{50(30)}$'s, mean survival times, or slopes of regression lines. Comparisons of $LD_{50(30)}$'s for the two groups indicate a neutron RBE of ~2.5 for production of acute mortality. (P.C.H.)

8179 PERMEABILITY CHANGES IN YEAST CELLS AFTER X-IRRADIATION AND STARVATION. Edward Spoerl, R. J. Niedzielski, and R. W. Biernat (Army Medical Research Lab., Fort Knox, Ky.). Radiation Res., 21: 86-90 (Jan. 1964).

Losses of P^{32}, 260-mμ absorbing material, and viability of irradiated and unirradiated yeast cells were measured throughout a 24-hour period of starvation after irradiation. Irradiated cells lost less P^{32} than unirradiated cells but lost equivalent amounts of 260-mμ absorbing material. Permeability to methylene blue was not altered. The loss of cell materials before a decrease in viability occurred precludes the change in viability as a cause of the loss. The differences observed in membrane passage of different materials contribute to the need to isolate specific changes for study from the usually complex responses to radiation. (auth)

8180 X-RAY DOSE AND ELECTROCONVULSIVE RESPONSES IN ADULT RATS. Marilyn Pollack and Paola S. Timiras (Univ. of California, Berkeley). Radiation Res., 21: 111-19(Jan. 1964).

Electroshock seizure responses were studied in control and irradiated adult male rats exposed to single whole-body x-ray doses of 15, 20, 25, 50, 100, 250, and 500 r. Irradiation at all dose levels produced a statistically significant, dose-dependent reduction in threshold for electroshock seizures which lasted 2 to 3 weeks after 15 or 20 r, 2 to 3 months after 25 to 250 r, and more than 8 months after 500 r. Although body weight was decreased temporarily (after 25 to 250 r) or permanently (after 500 r) in some of the irradiated rats, the magnitude, duration, and dose-dependency of the reduction in threshold appeared to vary independently of changes in body weight. Alterations in the pattern of maximal electroshock seizures occurred only after doses of 50 r or more and lasted generally for the entire experimental period even after the lower effective doses; they consisted of a shortening of the duration of clonus and total seizure after 50 to 500 r and a lengthening of tonic extension with shortening of tonic flexion after 500 r. The data are tentatively interpreted to indicate that whole-body x irradiation in doses of 15 to 500 r increases brain excitability as measured by lowering of seizure threshold and by facilitation of tonic convulsive phases; induces an earlier than normal onset of neuronal fatigue as shown by shorter durations of clonus and total seizure; and affects various parameters of brain activity to a different degree, suggesting a differential radiosensitivity of specific regions and functions of the central nervous system. (auth)

8181 PROLONGED GAMMA IRRADIATION AS RELATED TO LEARNING AND MOTIVATION IN THE RAT. Dunham H. Gilbert and Thomas M. Graham (Los Angeles State Coll.). Radiation Res., 21: 120-8(Jan. 1964).

Three groups of rats, matched on the basis of their performance on the first eight choice points of a seventeen-unit elevated T-maze, were exposed to prolonged γ irradiation for 4, 9, and 13 weeks, respectively. Subgroups in each irradiation-duration group received one of the following experimental conditions: no irradiation (control); exposure to 3 r/week; exposure to 30 r/week; or exposure to 300 r/week. Posttreatment testing on the entire maze revealed a significantly faster mean running speed for animals exposed to 3 r/week for 13 weeks. Error measures were not related to radiation treatment at any time. It was concluded that changes in motivation were responsible for the observed behavioral differences. (auth)

8182 EFFECTS OF X-IRRADIATION ON THE MITOTIC CYCLE OF EHRLICH ASCITES TUMOR CELLS. Jae Ho Kim and T. C. Evans (State Univ. of Iowa, Iowa City). Radiation Res., 21: 129-43(Jan. 1964).

The effects of x irradiation (300, 500, and 1000 r) on mitosis and DNA synthesis in Ehrlich ascites tumor cells were studied. Dose-effect relations and time sequence of effects on the two processes were compared. The technique of H^3-thymidine labeling of DNA with autoradiography was utilized, in conjunction with the mitotic index, to study alterations in the mitotic cycle. It was concluded that x irradiation affected cells in the G_2 and S periods so that the rate of exit from G_2 was reduced. Evidence, based on mean grain count per labeled cell and percentage of cells labeled, was found for a slight reduction in rate of DNA synthesis after irradiation. The delay in rate exit from G_2, however, was apparently a block at the end of the period. (auth)

8183 DARK RECOVERY PHENOMENA IN YEAST. 1. COMPARATIVE EFFECTS WITH VARIOUS INACTIVATING AGENTS. M. H. Patrick, R. H. Haynes, and R. B. Uretz (Univ. of Chicago). Radiation Res., 21: 144-63(Jan. 1964).

If x irradiated diploid cells of Saccharomyces cerevisiae are stored for 3 to 5 days in the dark in distilled water or in phosphate buffer at 30°C, their viability as determined by plating is much greater than if they are plated immediately after irradiation. A similar storage effect was observed with diploid cells treated with ultraviolet radiation or with nitrogen mustard (HN2). No such recovery was observed after heat inactivation or acridine-sensitized photoinactivation. In a given experiment, recovery is characterized by a constant dose-modifying factor, but a wide variation of the DMF is observed for different inactivating agents. Control experiments demonstrate that the recovery does not arise from post-irradiation cell multiplication in the storage medium. The storage procedure is also effective in reducing the fraction of respiratory-deficient colonies after ultraviolet or x irradiation. Recovery occurs in the dark and is partially additive to photoreactivation. Plating on a minimal medium immediately after exposure to x rays or ultraviolet also enhances viability on a constant dose-modification basis. Ploidies higher than diploid also exhibit recovery; on the other hand, haploid yeast does not recover from x-ray inactivation and displays only slight recovery from ultraviolet, or from HN2 inactivation. (auth)

8184 CHANGES IN SURVIVAL TIMES OF RATS AFTER TOTAL-BODY IRRADIATION AT DIFFERENT TIMES OF DAY. Karl Peters (Universität, Tübingen, Ger.). Strahlentherapie, 122: 554-7(Dec. 1963). (In German)

Different results are observed after total body irradiation of rats depending on the time of day and the periods of sensitivity at which the irradiations are done. Influences of the time of day on survival time, on mean survival time of the deceased animals, as well as on the LD_{50}, are discussed. A total of 404 rats was used for the investigations. (auth)

8185 EFFECTS OF SUBLETHAL RADIATION DOSES ON THE CYCLE AND ESTRUS OF WHITE LABORATORY MICE. [PART] II. Johannes Trautmann (Röntgeninstitut und der Strahlentherapeutischen Klinik am Städt. Krankenhaus Moabit, Berlin). Strahlentherapie, 122: 558-64(Dec. 1963). (In German)

Investigations concerning duration of the estrous cycle of the white laboratory mouse after 200 r total body x-ray irradiation showed that no discernible changes in the duration of the estrous cycle could be observed if mature animals were irradiated. Prolonged cycles were observed in those mature female mice that were irradiated with 200 r in utero at the 15th day of pregnancy. (auth)

8186 MITOTIC EFFECTS OF IONIZING RADIATION ON THE MALIGNANT AND NONMALIGNANT EPIDERMIS HYPERPLASIA OF MICE. V. EFFECTS OF SINGLE CONTACT IRRADIATION AFTER 10 DAYS OF PRETREATMENT WITH CARCINOGEN OR TUMOR ENHANCER. Kai Setaelae, Bjoern Lindroos, and Otto Nyyssoenen (Universität, Helsinki). Strahlentherapie, 122: 565-90(Dec. 1963). (In German)

The mitotic response to a single exposure of the mouse back to a $Sr^{90} + Y^{90}$ contact source, with a dose rate of about 1000 rad/9 min, was analyzed in two experimentally provoked and in several respects opposite epidermal conditions. Female mice of the skin-tumor-resistant RA strain were pretreated with carcinogen, and with tumor enhancer, respectively, for 10 days, and exposure took place one day after the cessation of pretreatment. In each series and in each animal, 500 mitotic figures (normal and pathologic) and the corresponding number of non-dividing epidermal cells were counted and classified at postexposure hours 1, 3, 6, 12, 24, 48, and 72. The total number of mitoses examined amounted to 102,500 and that of non-dividing nuclei to 1,703,277. Conclusions were drawn only when the difference between the corresponding series was highly significant ($P < 0.001$). It appeared that under the experimental conditions the nature and the degree of severity of the irradiation response were not correlated with the frequency of the mitotic activity (i.e., with the first of the two growth facets), as long as the cell maturation (i.e., the second growth facet) was normal or nearly normal (benign epidermal hyperplasia provoked by the noncarcinogenic tumor enhancer Tween 60). On the contrary, the condition characterized by a highly significantly lower mitotic rate as well as by delayed and misguided maturation (malignant epidermal hyperplasia provoked by the carcinogen 9,10-dimethyl-1,2-benzanthracene) proved preferentially more vulnerable to irradiation. It also became evident that no single-type of mitotic disturbance was specific of the irradiation response of either epidermal condition. (auth)

8187 BIOGENIC AMINES IN URINE AND BLOOD OF RATS AFTER SUBLETHAL WHOLE-BODY IRRADIATION. II. NORMAL DEVIATIONS IN BODY AMINES APPEARING IN THE FIRST HOURS AFTER RADIATION BURDEN. Franz Franzen, Hubert Gross, and Gerhard Friedrich (Universität, Cologne). Strahlentherapie, 122: 591-4(Dec. 1963). (In German)

An increased amount of noradrenaline, adrenaline, and serotonine was determined by fluorescence-spectrophotometry in the urine of rats 2 hours after a single, short-time total-body irradiation with 800 r. An increased amount of histamine was found 4 hours after irradiation. Blood analysis done 6 hours after irradiation showed a slightly increased concentration of tryptamine, serotonine, noradrenaline, and adrenaline. (auth)

8188 CHANGES IN THE CONCENTRATION OF RADIORUBIDIUM IN THE SALIVARY GLAND AND OTHER ORGANS OF RATS AFTER IRRADIATION. Miloslav Rakovic, Jarmila Pradáčova-Ondracková, and Vladimír Gregora (Univ. of Prague). Strahlentherapie, 122: 618-21 (Dec. 1963). (In German)

After irradiation of rats an excretion of previously administered radiorubidium from several organs was observed to be similar to the one for radiopotassium described in the literature. No loss of radiorubidium was found in the parotid gland at the second day after irradiation agreeing with other reports that this gland has a considerable relative radioresistance. Radiorubidium was

accumulated heavily in the parotid gland by the third day after irradiation showing, therefore, a behavior different from other organs previously investigated. (auth)

8189 MORPHOLOGICAL CHANGES IN THE OPTIC NERVE UNDER THE ACTION OF IONIZING RADIATION. L. S. Berggryun. Tr. Smolensk. Med. Inst., 15: 190-9 (1962).

Morphological changes in the optic nerve were traced in experiments on 20 rabbits subjected to gamma irradiation with Co^{60} in doses of 1000 and 1500 r. Starting at 48 minutes after irradiation, the animals died or were killed over a 15-month period. The eye was fixed in 20% neutral formalin. The frozen sections were impregnated with silver nitrate by the gold-deposition method and the nuclei stained with hematoxylin. Histological changes developed in the optic nerve within 48 minutes after irradiation, taking the form of tissue edema and irritation of the larger fibers. The irritation increased on the 4th day and the fibers exhibited thickening and slight intumescences. Vacuolar dystrophy and disintegration to large fragments were noted on the 6th-12th day. Hyperargentophilia, irregularity of shape, and terminal excrescences of neuroplasm were observed on the 15th-31th day. Irritation and degeneration of small nerve fibers increased. After 15 months the optic nerve still had a normal structure but small fibers predominated in its tracts. (Referativnyy Zhurnal, Biologiya, No. 16, Aug. 1963)

8190 RADIOBIOLOGICAL STUDIES OF VACCINIA VIRUS. J. D. Friesen, D. Sankoff, and L. Siminovitch (Univ. of Toronto and Ontario Cancer Inst., Toronto). Virology, 21: 411-24(Nov. 1963).

Radiation studies of vaccinia virus were carried out using Co^{60} gamma rays and ultraviolet light (UVL). When virus particles were irradiated with gamma rays a two-component survival curve was obtained. The capacity of Earle's L cells to support the growth of vaccinia virus was relatively sensitive to gamma rays. Infectious centers formed by infecting L cells with vaccinia virus were irradiated at various times during the eclipse period of virus growth (the Luria-Latarjet experiment). When irradiated with gamma rays, infectious centers exhibited an initial sensitization to inactivation that persisted for at least 3 hours. At times later than 3 hours after infection the infectious centers became progressively more resistant to inactivation by gamma rays (stabilization); the survival curves remained almost single-hit throughout the eclipse period. Studies with FUdR, an inhibitor of DNA synthesis, showed little stabilization in the absence of viral DNA synthesis. Free particles of vaccinia virus were inactivated according to single-hit kinetics by UVL. The capacity of L cells to form virus was relatively resistant to UVL. In the Luria-Latarjet experiment using UVL, the survival curves of the infectious centers remained single-hit for the first 3 hours of the eclipse period, with slopes about half that of the survival curve for the free virus. Starting between 3 and 4 hours after infection, the survival curves became multihit, but their slopes remained parallel to the slopes of the survival curves of the early infectious centers. Possible interpretations of the results are discussed. (auth)

8191 ACTIVE IMMUNITY TO GAS GANGRENE IN MONKEYS DURING ACUTE RADIATION EXPOSURE. E. K. Dzhikidze, A. S. Aksenova, and Z. K. Stasilevich (Inst. of Experimental Pathology and Therapy, Academy of Medical Sciences, USSR). Zh. Mikrobiol., Epideminol. i Immunobiol., No. 7, 68-72(July 1963).

It was demonstrated that revaccination six months after immunization with sorbed tritoxoid prevented development of a fatal illness in monkeys subjected to fractionated irradiation in doses of 500 and 600 r. The animals were resistant to inoculation with Cl perfringens. All of the monkeys were immunized twice at a 20-day interval with sorbed tritoxoid containing Cl perfringens antigen. Reimmunization was with tritoxoid. The animals were irradiated with radioactive cobalt in a dose of 388 r. A second series of experiments was conducted to determine the significance of the internals between revaccination and irradiation in the development of immunity to gas gangrene. Six monkeys revaccinated 6 months after immunization and one month before irradiation were inoculated with Cl perfringens, 3 dying and the remainder incurring a severe illness lasting one month. It was concluded that revaccination 24 or more hours after massive exposure to irradiation stimulates accumulation of Cl perfringens antitoxin in the blood, although there seems to be no correlation between the antitoxin level and the intensity of immunity. Revaccination 24 or more hours after irradiation in sublethal doses is of little efficacy, but revaccination one month before massive irradiation increases the survival rate on inoculation with a lethal dose of gas-gangrene pathogen. (OTS)

8192 RADIOBIOLOGICAL STUDIES OF VACCINIA VIRUS AND ENCEPHALOMYOCARDITIS VIRUS. James Donald Friesen. Thesis, Toronto, Univ. of Toronto, 1963. 140p.

Studies of vaccinia virus and encephalomyocarditis virus (EMC) were carried out using 2 types of radiation, ultraviolet light (UV) and Co^{60} γ rays. The infectivity of both viruses was inactivated by UV according to single-hit kinetics; EMC was also inactivated in a single-hit manner by γ rays. Vaccinia virus, on the other hand, exhibited a 2-component survival curve when irradiated with γ rays. The possible reasons for this result are discussed. Infectious centers formed by infecting L60 cells with vaccinia virus or with EMC virus were irradiated at various times during the eclipse period of virus growth (the Luria-Latarjet experiment). When infectious centers of vaccinia virus were irradiated with UV the survival curves remained single-hit for the first 3 hours of the eclipse period, with slopes $\sim \frac{1}{2}$ that of the survival curve for the free virus. Starting 4 hrs after infection the survival curves became multiple-hit, but the ultimate slopes remained parallel to the slopes of the survival curves of the early infectious centers. The infectious centers of vaccinia virus exhibited an initial sensitization to inactivation when irradiated with γ rays. This initial sensitivity persisted for at least 3 hrs, after which time the infectious centers became progressively more resistant to inactivation by γ rays. The survival curves remained more or less single-hit throughout the eclipse period. Studies with FUdR, an inhibitor of DNA synthesis, showed that the stabilization did not occur in the absence of viral DNA synthesis. Infectious centers of EMC virus became progressively more resistant to UV as virus growth progressed. The survival curves remained single-hit through the eclipse period. Possible interpretations of these results are discussed in the light of present knowledge of the growth of vaccinia and EMC virus. (Dissertation Abstr.)

8193 THE EFFECT OF IRRADIATION ON SPOROGENESIS, GAMETOPHYTE DEVELOPMENT AND SEED SET IN YELLOW-ANTHERED DALLISGRASS. Keith Hilton Patrick. Thesis, College Station, Tex., Agricultural and Mechanical Coll., 1963. 105p.

A study was initiated to evaluate the effects of irradiation on selected clones of yellow-anthered dallisgrass. The studies were planned to determine the effects of radiation on microsporogenesis, megasporogenesis, and embryo sac development and to relate the effects on gametogenesis to fertility as indicated by seed set and pollen quality. It was indicated in these studies that any aberrations in the chromosomes caused by irradiation were detrimental to both the megagametophyte and the microgametophyte. It was apparent that there was no selectivity for a balanced megaspore within the tetrad of megaspores. In all cases only the chalazal megaspore was functional. Damage to the female gametophyte may be definitely more severe as a factor in fertility, since only the single chalazal megaspore is potentially functional in this species while numerous microspores are produced. Neutron and γ radiation affected both male and female gametophytes though not necessarily to the same extent. The results show that while irradiation at the levels studied generally reduces fertility, it is possible to produce significant desirable changes in growth characteristics without causing serious fertility problems. Also, it was apparent that irradiation causes reduction in fertility that cannot be explained on the basis of visible chromosome aberrations. These results indicate that a large population of plants are needed if a breeder is to have reasonable success in selecting desirable mutant plants that are fertile. (M.P.G.)

8194 RADIOBIOLOGIYA; BIOLOGICHESKOE DEISTVIE IONIZIRVYUSHCHIKH IZLUCHENII. (Biological Effects of Ionizing Radiation). D. E. Grodzenskii. Moscow, Gosatomizdat, 1963. 199p.

A review is given of biological effects of ionizing radiation, considering the physical and chemical effects on a cell and on whole organisms. Chemical protection and genetic factors in humans are also discussed. (R.V.J.)

Radiation Effects Therapy and Countermeasures

8195 (AD-402191) PROTECTION FROM IRRADIATION— ULTRAVIOLET, SOFT AND CONVENTIONAL X-RAY. Annual Report No. 5, July 1, 1958–December 31, 1962. John M. Knox (Baylor Univ., Houston, Tex. Coll. of Medicine). Contract DA-49-007-MD-953. 80p.

The protective effects of 2 experimental compounds against radiation injury in mice were demonstrated using the endpoint of LD 100 for 30 days after the administration of du Pont compound 990, 3-5-demethyl-1-dimethyl carbamyl pyrazole, or du Pont compound 1903, 4-chloro-1-dimethyl carbamyl pyrazole. Preliminary studies in dogs, rats, and guinea pigs showed the compounds were well tolerated when administered orally or parenterally. Compound 990 also had a protective effect against ultraviolet-induced erythema in rabbits. Progress is reported in studies on the effects of local skin temperature on ultraviolet burns of mice; the effect of ultraviolet light on the sulfhydryl and disulfide content in living human epidermis; the effect of methoxypsoralen on skin and eye response to ultraviolet radiation; the relation of dosage of ultraviolet to the type of tumor produced in the skin and eyes of rats and mice; a study of the possible co-carcinogenetic effects of cigarette tar and ultraviolet light in mice; and the histochemistry and histopathology of acute ultraviolet injuries of the epidermis and eyes of mice, rats, guinea pigs, and rabbits. (C.H.)

8196 (AD-425091) GLYCIDIC ESTERS AND/OR ORGANIC DISULFIDES, AND RELATED SUBSTANCES, AS SOURCES OF ANTI-RADIATION DRUGS. Annual Progress Report No. 2, July 1, 1961–September 30, 1963. (Including Interim Research Report No. 16, July 1, 1963–September 30, 1963). Lamar Field (Vanderbilt Univ., Nashville). Dec. 4, 1963. Contract DA-49-193-MD-2030. 33p.

Thirty compounds were prepared and submitted for testing as to protective effects against radiation injuries. Procedures are reported that were used in the preparation of the compounds, most of which were aminothiol-sulfonates or aminodisulfides. A list is included of papers prepared during the period covered by this report. (C.H.)

8197 (JPRS-22613(Del.)(p.29-39)) ON THE MECHANISM OF CYSTEAMINE PROTECTIVE ACTION. E. A. Val'dshteyn. Translated from p.126-33 of "Reaktsiya Kletok na Ekstremal'nye Vozdeystviya."

The protective effect of cysteamine was studied on two strains of E. coli B and B/r. Cysteamine protects bacteria from death in the presence as well as in the absence of radiosensibilizing agents (O_2 and NO). Postirradiation cysteamine protection was observed when irradiation and addition of cysteamine after irradiation were applied in strictly anoxic conditions. Thus, cysteamine protects bacteria from short-lived oxygen-dependent primary injuries determining the oxygen effect, long lived oxygen-dependent primary injuries, and short-lived oxygen-independent injuries. (auth)

8198 EFFECT OF MITOMYCIN-C ON THE FREQUENCY OF CHROMOSOME ABERRATIONS PRODUCED BY X-RAYS. Hajime Matsuura, Shigeyuki Tanifuji, Takashi Saho, Masaki Iwabuchi (Hokkaido Univ., Sapporo). Am. Naturalist, 97: 191-3(May-June 1963).

The effects of mitomycin-C on the frequency of chromosome aberrations induced by x irradiation in flower stems of Trillium kamtschaticum were studied. It was found that mitomycin-C modified the pattern and the frequency of chromosome aberrations. The yield of exchanges was remarkably increased and the total frequency of all visible breaks was also increased. (P.C.H.)

8199 THE EFFECT OF DECORTICATION ON RADIATION SENSITIVITY AND RADIATION RESISTANCE. P. V. Simonov (Burdenko Hospital, Moscow). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 745-8(Aug. 1963).

Experiments were carried out on 15 control and 11 rabbits following bilateral removal of the cerebral hemispheres. Low x ray doses (100 r) caused a change in a number of physiological functions in the control animal, but had no effect on them in decorticate rabbits. Nevertheless the decorticate animals proved to be less resistant to greater irradiation doses of 400 and 800 r. It was concluded that decortication diminishes the range of adaptive possibilities of the body, rendering it less sensitive and less resistant to the action of ionizing radiation. (auth)

8200 THE EFFECT OF CYSTAMINE ON OXIDATIVE PHOSPHORYLATION IN THE SPLEEN OF IRRADIATED ALBINO RATS. V. G. Vladimirov (Kirov Military Medical Academy, Leningrad). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Transl.), 54: 1236-8(Nov. 1963).

X irradiation at a dose of 600 r leads to changes of the oxidative phosphorylation level in the spleen of rats. A drop of the phosphorylation level and its dissociation from

the tissue respiration occurred. Administration of cystamine (in prophylactic effective doses) to the animals prior to the irradiation decreased the changes of oxidative phosphorylation in the spleen, without eliminating them completely. (auth)

8201 SELECTIVE CHEMICAL PROTECTION AGAINST RADIATION IN TUMOR-BEARING MICE. Emanuel E. Schwartz, Bernard Shapiro, and George Kollmann (Albert Einstein Medical Center, Philadelphia). Cancer Res., 24: 90-6(Jan. 1964).

The possibility of obtaining differential protection of normal and malignant tissues against radiation in tumor-bearing mice by pretreatment with 2-mercaptoethylguanidine was investigated. Although neither the mammary tumor nor the leukemia studied appeared to be protected against local x-ray exposure at sites of transplantation, it was not possible to greatly improve the therapeutic index of whole-body x radiation by this means. In the case of the mammary tumor the whole-body x radiation dose that could be administered was still below the level needed to restrain tumor growth. Results obtained in the treatment of the more radiosensitive leukemia suggested that different routes of administration resulting in a more favorable metabolism and distribution of protective compound may improve the results. (auth)

8202 THE DISTRIBUTION AND THE CHEMICAL FORMS OF THE RADIATION-PROTECTIVE AGENT AET IN LEUKEMIC MICE. George Kollmann, Bernard Shapiro, and Emanuel E. Schwartz (Albert Einstein Medical Center, Philadelphia). Cancer Res., 24: 120-4(Jan. 1964).

The distribution and the chemical nature of the protective agent in the various tissues of C57BL/6J male tumor-bearing mice given a protective dose of 2-mercaptoethylguanidine (MEG), the transguanylated form of the radiation-protective agent (AET), S-(2-aminoethyl)thiuronium bromide hydrobromide were studied. The mice carried a subcutaneously transplanted leukemia. Results were obtained 20 minutes after an intraperitoneal injection of 140 mg/kg MEG-S^{35} and at 30 minutes after oral administration of 400 mg/kg MEG-S^{35}. Under both conditions the tumor took up less protective agent than did most of the vital organs. The tumor contained the same S^{35}-labeled chemical forms that normal tissues contained, namely, protein-bound S^{AET}, GED, 2-guanidoethanesulfinic acid, taurocyamine, sulfate, and S-acetyl-2-mercaptoethylguanidine. The protein-bound form consisted mainly of thioester-bound and mixed disulfide-bound protective agent. The tumor had less thioester-bound protective agent than did the small intestines, liver, and kidneys. In vitro studies of protective agent uptake by tissue slices showed that tumor slices took up as much protective agent as did liver or spleen slices. Compared with normal animals, tumor-bearing animals had difficulty excreting the protective agent, apparently as the result of some renal defect. (auth)

8203 CHEMICAL PROTECTION FROM RADIATION. S. A. Barker (Univ. of Birmingham, Eng.). Discovery, 24: No. 6, 24-5; 28-30(June 1963).

The use of chemicals for protection of man against radiation is discussed. Special attention is given to sulfur compounds and their mechanism of protection. (P.C.H.)

8204 LIVER DAMAGE IN MICE TREATED WITH 4-(p-DIMETHYLAMINOSTYRYL)QUINOLINE, A RADIOMIMETIC AGENT. M. L. Davis, W. D. Gude, and M. Asano (Oak Ridge National Lab., Tenn.). Lab. Invest., 12: 991-6(Oct. 1963).

The effects of intravenous injections of the radiomimetic agent 4-(p-dimethylaminostyryl)quinoline on the liver were studied in mice of the RF/Up and (101 × C3H) F_1 strains. The effects were assessed by use of the Bromsulphalein (BSP) liver function test and histologic examination of liver sections. Liver cell lipoid vacuolation was noted within 1 hour after injection of 4 mg of the drug and was very severe before 24 hours had elapsed. BSP testing on succeeding days indicated progressive liver damage that reached a peak on the sixth day in the RF/Up mice and on the third day in the (101 × C3H) F_1 mice. This was accompanied by extensive liver cell necrosis, especially in the central part of the lobule. Resolution of the lesions occurred gradually over the 17-day observation period, but residual cytologic changes were still present at the end of this time. (P.C.H.)

8205 THE ACTION OF SPLEEN EXTRACT ON PAN-IRRADIATED ANIMALS. Liana Bolis, Fiorenza Bellini, F. Fussi, and A. Majoni (Università, Milan). Med. Lavoro, 53: 705-13(1962). (In Italian)

After a review of the biological effects of ionizing radiations and the protective action of some substances, the results obtained by administering an aqueous spleen extract to rats and mice subjected to irradiation are reported. When the aqueous spleen extract was administered intravenously to rats irradiated with a single 680 r dose, a good protective action was noted (reduction in mortality rate, regaining of body weight, and slight quantitative alterations in the blood leucocyte counts). In mice irradiated with 250 r doses, three times weekly, the intraperitoneal administration of aqueous spleen extract resulted in return to normal values of the phagocitic activity of the reticulo-endothelial system. The spleen extract was active only in aqueous solution, and it was effective whether it was administered immediately before or after the irradiation; no protective effect was obtained on giving the extract 12, 24, or 60 hr after irradiation. The lipid spleen extract gave negative results. (auth)

8206 PROTECTIVE ROLE OF MERCAMINE AND CYSTAMINE DURING REPEATED IRRADIATION. A. Shamakhmudov. Med. Zh. Uzbekistana, No. 8, 23-8 (1963).

Mice and rats were used to test the radioprotective effect of mercamine and cystamine. The drugs were administered intraperitoneally either before or after repeated exposure to x rays. In all instances the initial radiation dosage was 15 r and the second dose was 700 r for mice and 800 r for rats. Test animals were classed as follows: group 1, irradiated animals (controls); group 2, cystamine and mercamine injected before irradiation; and group 3, protectors used after the initial irradiation and immediately before the second exposure. Survival rates before the second exposure were 30-80% higher in group 2 than in group 1. No marked radiation protective effects were observed after the second exposure in group 3. (OTS)

8207 RECOVERY EFFECTS OF HOMOLOGOUS TESTES DNA INJECTED INTO TOTAL-BODY IRRADIATED (600 R) INFANTILE RATS AND MICE. N. Savković (Inst. of Nuclear Science "Boris Kidrich," Belgrade). Nature, 200: 1073-4(Dec. 14, 1963).

The administration of testes DNA from mature male rats and mice increased the percentage of survival of infantile rats and mice exposed to 600 r x radiation. The DNA was administered immediately after irradiation. (C.H.)

8208 RADIATION PROTECTIVE EFFECT AND PHARMACOLOGICALLY CHANGED ACTIVITY OF THE

RETICULO-ENDOTHELIAL SYSTEM. Kurt Flemming (Heiligenberg-Institut, Baden, Ger. and Universität, Freiburg i. B.). Nature, 200: 1117-18(Dec. 14, 1963).

Olive oil, triolein, 2-oleodistearin, and tricaprin stimulated the phagocytic activity of reticulo-endothelial cells 24 hr after injection and ethyl palmitate, ethyl stearate, ethyl oleate, and cholesterol oleate depressed it at this time. All these lipids exerted a protective effect against 610 r whole-body x radiation in mice. The concept of enhanced activity of the reticulo-endothelial system as a factor in the survival of irradiated mice is discussed. (C.H.)

8209 TRANSFORMATION OF HAEMOPOIETIC CELLS OF BONE MARROW ALLOGRAFTS INTO LYMPHOCYTES IN X-IRRADIATED DOGS. I. L. Chertkov, M. N. Novikova, L. S. Rogacheva, L. L. Shepshelevich, A. S. Maxymenko, and M. O. Raushenbach (Inst. of Haematology and Blood Transfusion, Moscow). Nature, 200: 1170-2(Dec. 21, 1963).

Dogs x-irradiated with 1000 r received bone marrow allograft in intravenous injections. The bone marrow transplantation failed in its therapeutic effect; the dogs died 11 to 15 days after irradiation. The graft cells re-populated and differentiated in the normal way for several days, but after the 7th to 8th day, peculiar hyperbasophilic cells were revealed and normal hemopoiesis stopped. In the bone marrow and peripheral blood, hemocytoblasts transformed into lymphocytes through several transitional forms. This phenomenon is similar to that observed in lymph nodes after antigenic stimulation, suggesting that bone marrow allograft transforms into immunologically competent cells which can induce the graft vs host reaction. Further experiments suggest that hyperbasophilic cells and their derivatives (lymphocytes) are morphological bases of secondary disease and other transplantation immunity reaction, and that secondary disease can be induced only by the immunologically competent cells derived from the sten cells of bone marrow. Hence, for prophylaxis of secondary disease, it is necessary to prevent transformation of the graft after lymphoid type. (D.L.C.)

8210 6-AMINONICOTINAMIDE AND THE RADIOSENSITIVITY OF HUMAN LIVER CELLS IN CULTURE. D. L. Dewey and Christine Hawes (Mount Vernon Hospital, Northwood, Middx., Eng.). Nature, 200: 1176-8(Dec. 21, 1963).

The effects of 6-aminonicotinamide on the radiosensitivity of human foetal liver cells and Ehrlich ascites tumor cells were studied using x rays in separate experiments. 6-Aminonicotinamide was found to have a sensitizing effect on the radiosensitivity of liver cells when measured by reproductive integrity, but none when measured by chromosome damage; no effect was observed in the chromosome damage in tumor cells. The reproduction and chromosome experiments differed from each other in that 6-aminonicotinamide was added before the cells were allowed to attach to glass in the former, while the order was reversed in the latter. It is concluded that 6-aminonicotinamide reduces the plating efficiency. (D.L.C.)

8211 PROTECTIVE EFFECT OF MEG ON RADIATION INJURIES OF HEMATOPOIETIC SYSTEM IN MICE AND RATS. Shigetoshi Antoku and Shozo Sawada (Hiroshima Univ.). Nippon Igaku Hoshasen Gakkai Zasshi, 23: 674-82(Aug. 1963).

MEG markedly modified the response of Fe^{59} uptake by hematopoietic systems, bone marrow, peripheral blood leukocytes and spleen, thymus, and body weight to lethal x irradiation in ddN mice. On the other hand, MEG failed to modify the response of the Fe^{59} uptake, peripheral blood leukocytes, erythrocytes, hematocrit, reticulocytes, organ weight, and body weight to sublethal x irradiation in Wister and Donryu rats. Donryu rats and Wister rats were more sensitive to toxicity of AFT_{Br} and MEG_{SO_4} as compared with ddN mice. (auth)

8212 L-ASPARTIC ACID K, Mg SALTS FOR RADIATION SICKNESS. Keiichi Matsuura and Rikio Imada (Hiroshima Red Cross Hospital). Nippon Igaku Hoshasen Gakkai Zasshi, 23: 792-800(Sept. 1963). (In Japanese)

K and Mg salts of L-aspartic acid (Aspara, produced by Tanabe Seiyaku) were administered to patients suffering radiation sickness during radiation therapy. It was found to be very effective. An imitation Aspara was tried and found to be less effective than true Aspara. No radioprotective or radiorecovering effects of Aspara were observed on female mice given 600 r of whole-body irradiation with a 210-kvp x-ray unit. (TCO)

8213 CLINICAL AND TREATMENT FEATURES OF OPEN INFECTED FRACTURES IN THE KNEE JOINT REGION IN CONJUNCTION WITH RADIATION SICKNESS (EXPERIMENTAL STUDY). B. V. Sakharov. Ortopediya, Travmatol. i Protezirovanie, 24: No. 8, 53-8(Aug. 1963).

Clinical aspects and the course of treatment of open infected fractures in the knee joint region against a background of moderate and severe radiation sickness are discussed. The experiment involved 35 healthy dogs of both sexes. In all, three experiments were involved: on open infected fractures in the knee joint region in conjunction with radiation sickness; open infected fractures in the knee joint region without radiation sickness; radiation sickness without trauma. Infected open injury to the knee joint against a radiation sickness background is a severe affection. The use of delayed surgical and drug treatment (antibiotics, vitamins, antihistamine preparations) afforded survival of at least one-half of the animals. Oral use of phenoxymethyl-penicillin in large doses established in the blood and synovial fluid of the damaged knee joint a therapeutic concentration of antibiotic of long duration (not less than a day). In radiation damage to knee joint accompanied by fracture of the bone fragment, the best method of surgical treatment is osteosynthesis using metal parts. In open infection of a damaged knee joint against a radiation sickness background, even with proper treatment a tendency toward formation of deforming arthrosis was observed. (OTS)

8214 THE INFLUENCE OF RADIOMIMETIC SUBSTANCES ON DEOXYRIBONUCLEIC ACID SYNTHESIS AND FUNCTION STUDIED IN ESCHERICHIA COLI/PHAGE SYSTEMS. VI. THE ACTION OF Di(2-CHLOROETHYL)METHYLAMINE (HN2) ON BACTERIOPHAGE T2 DURING THE INTRACELLULAR GROWTH CYCLE. A. Loveless (Royal Cancer Hospital, London). Proc. Roy. Soc. (London), Ser. B, 159: 348-65(Jan. 14, 1964).

Studies were made on the effects of di(2-chloroethyl)-methylamine on bacteriophage T2 and E. coli strains B and B/r. The procedures adopted and the results afforded are reported. Five main conclusions were drawn: immediately after infection of the cell the phage material offers a more resistant target to HN2 than does the extracellular phage; the first 2 or 3 min after infection there is a small increase in sensitivity; a striking increase in resistance occurs around the 8th min together with a change in form of the survival curves to a multi-hit type; thereafter, though the curves remain multi-hit a second increase in sensitivity is manifested; there is a component of the infected cell population that shows a high degree of resistance at all

times. The first two results are attributed to changes in the geometrical form of the phage deoxyribonucleic acid (DNA) consequent upon its extrusion into the cell from the phage head; it is also considered that the early transient increase in sensitivity might be associated with the formation of a DNA–RNA complex. The third result is attributed to DNA replication, which is known to occur at this time, thus providing a multiplicity of target, though it is not known if multiplicity reactivation takes place. The fourth result is thought likely to be the consequence of the condensation of phage DNA into discrete units having the same geometry as that of the fully formed phage. No explanation is currently offered for the occurrence of highly resistant complexes. (P.C.H.)

8215 ACCUMULATION OF ACUTE INJURY IN THE MOUSE SUBJECTED TO SPLIT OR FRACTIONATED DOSES OF X-RADIATION OR GAMMA RADIATION. Sylvanus A. Tyler and S. Phyllis Stearner (Argonne National Lab., Ill.). Radiation Res., 21: 16-25(Jan. 1964).

A model is presented for the kinetics of injury accumulation in the mouse after acute whole-body irradiation with x or γ rays. Total doses covered the 30-day lethal range. The postulated basis on which the model rests includes the assumption that reversal of time-dependent effects stops after about 5 hours. The dependence of $LD_{50(30)}$ on time is found to be the same up to 5 hours, whether protracted, split, or fractionated doses are employed. After 5 hours, mice subjected to split exposure show significantly greater sensitivity to radiation effects than do mice given a single protracted exposure. It is shown that this observed difference in sensitivity is a consequence of the model and that the processes by which injury accumulates are unaltered by changes in exposure configuration. It is demonstrated, by using the normalized variable, D/D_0, that the results are compatible with those of others. (auth)

8216 CHANGES IN THE SENSITIVITY OF MICE TO TYPHOID ENDOTOXIN DURING RADIATION SICKNESS. Yu. S. Varenko. Tr. Donetsk. Med. Inst., No. 21, 79-81 (1962).

Sensitivity to typhoid endotoxin introduced intraperitoneally to mice at different periods before and after whole-body irradiation in a dose of 500 r increased during the entire period of radiation sickness. The peak of death of the animals was observed during the period of climax, on the 12th day. (Referativnyy Zhurnal, Biologiya, No. 15, Aug. 1963)

8217 CERTAIN CHARACTERISTICS OF THE COURSE OF ACUTE RADIATION SICKNESS IN THE PRESENCE OF EXPERIMENTAL FRACTURES OF LONG BONES. V. D. Belousov. Tr. Kishinevsk. Gos. Med. Inst., No. 16, 66-72 (1962).

Operative fracture of long bones was performed on mature dogs or 7-week-old puppies that had been subjected to whole-body x irradiation in a dose of 250 r under aseptic conditions while anesthetized; intramedullary fixation of the bone fragments or immobilization of the limb in a plaster cast was then carried out. The radiation sickness terminated in recovery in all animals. In adult dogs operated on 24 hours after irradiation the eosinophils disappeared from the peripheral blood during the first few days of illness and body temperature dropped to 35-36° on the day of the operation, these being poor prognostic signs; the signs did not point to a poor outcome in the operated puppies. The combined affection (radiation sickness and fracture) terminated in death in half of the mature dogs. No deaths occurred among the puppies and the first signs of a callus formation was detected roentgenologically in them 7-10 days earlier than in the mature animals. (Referativnyy Zhurnal, Biologiya, No. 16, Aug. 1963)

8218 THE EFFECT OF A COURSE OF SHORT FOCAL-LENGTH X-IRRADIATION ON THE GROWTH OF BONES IN EXPERIMENTS AND IN CHILDREN. N. D. Parfenova. Tr. Saratovsk. Med. Inst., No. 36, 321-8(1962).

The effect of therapeutic doses of soft x rays (600-3000 r) on the growth of bone was studied on the basis of changes in the length of the ray on rentgenograms in 15 puppies irradiated two to six times at one-month intervals at ages of 2-10 months. Brief cessation of lengthwise growth of bone was observed in only two cases. It was concluded that therapeutic doses of x rays have no effect on the growth and structure of bones in puppies. On rentgenograms of 22 out of 55 children irradiated along the course of hemangioma of the extremities, shortening of the bones and changes in their structure in the zone of x irradiation was noted. Such an effect was noted only in cases of daily x irradiation with the maximum single doses. To prevent x-ray injury of bones, it is recommended that x irradiation of hemangioma be carried out with single doses no higher than 200 r at intervals of 3-6 months. (Referativnyy Zhurnal, Biologiya, No. 15, Aug. 1963)

8219 THE DYNAMICS OF PATHOHISTOLOGICAL CHANGES IN THE RETINA OF THE EYE IN EXPERIMENTAL ACUTE RADIATION SICKNESS. L. S. Berggryun. Tr. Smolensk. Med. Inst., No. 15, 180-9(1962).

Histological changes in the retina after single whole-body irradiation of rabbits with Co^{60} in doses of 1000 and 1500 r, and guinea pigs, in doses of 400 r develop rapidly, although they are of a limited nature, they affect the major structures of different cells of the ganglion layer and certain axons of the layer of nerve fibers, and also a number of elements of the internal and external nuclear layers. The changes indicated are not specific, although the extent of degeneration in the ganglion cells is connected with the duration of the disease. (Referativnyy Zhurnal, Biologiya, No. 15, Aug. 1963)

8220 NUCLEIC ACID CONTENT IN THE TISSUES OF ANIMALS IRRADIATED AND TREATED WITH AN ANTI-RADIATION COMPLEX. N. F. Lipkan and M. T. Pindich (Kiev Post-graduate Inst. for Physicians). Ukr. Biokhim. Zh., 35: 514-19(1963). (In Russian)

Under the effect of nucleic metabolism activators at a time remote from that of the irradiation (30 days) the restoration of the nucleic acid content in rats goes on at a slower rate than in guinea pigs. The nucleic acid content in the small intestine wall is restored earlier than in other organs. The nucleic acid content in the spleen is restored more slowly than in other organs; the liver occupies an intermediate position. (auth)

8221 ANTI-RADIATION AND ANTI-OXIDATION PROPERTIES OF SOME POLYPHENOLS. V. A. Baraboi and B. Y. Medovar (Bogomoletz Inst. of Physiology, Academy of Sciences, Ukrainian SSR and Kiev Medical Inst.). Ukr. Biokhim. Zh., 35: 924-30(1963). (In Ukrainian)

The anti-oxidation activity of a number of polyphenols and ascorbic acid was assayed by their capacity for retaining accumulation of peroxides in irradiated oleic acid. The anti-radiation efficacy of the preparations was determined by the survival of mice irradiated by 600 r (minimum absolutely lethal dose of radiation) to which the preparations were administered on a phosphate buffer at pH 7.2 thirty minutes before irradiation or immediately afterwards. The average lifetime of the animals that died was

also taken into consideration. All investigated substances inhibited fat oxidation to a lesser or greater extent. A reliable anti-radiation effect, both defensive and therapeutic, is possessed by eglantine extract, galascorbin and tanin; rutin is less reliable. The correlation between the anti-oxidation and the anti-radiation effect of polyphenols was not elucidated. (auth)

8222 BIOLOGICHESKAYA OTSENKA PREPARATOV DLYA PROFILAKTIKI I LECHENIYA LUCHEVOI BOLEZNI. (Biological Evaluation of Drugs for Prophylaxis and Cure of Radiation Sickness). D. I. Zakutinskii and L. N. Selivanova. Moscow, Medgiz, 1960. 151p.

A comprehensive analysis was made of the pathogenesis of radiation sickness. The main principles of the experimental production of sickness and the clinical evaluation of drugs used for preventing and treating are described. Some data are given on the toxicity of drugs and on their preventative and therapeutic effects. Recommendations for pharmacological and clinical control are also included. (R.V.J.)

8223 ON THE BIOCHEMISTRY OF RADIATION EFFECTS. H. Engelhard (Universität Göttingen, Ger.). p.615-23 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

Fundamental processes involved in the effects of irradiation on substances present in the body are discussed, and conclusions drawn from these processes from the standpoints of diagnosis and therapy are examined. The points considered as regards the effect of ionizing radiation are: the ionization itself; the molecules excited by ionization; and the radicals that are formed. (P.C.H.)

8224 THE EFFECT OF IONIZING RADIATION ON CERTAIN BIOCHEMICAL INDICATORS OF THE BLOOD. G. N. Elpat'evskaya. p.99-103 of "Rentgeno-Radiologiya Radiobiologiya i Dozimetriya." Moscow, 1962.

Prolonged gamma irradiation in doses of 0.5 and 1 roentgen units for a period of six months produced chronic radiation disease in rats. A reduction in readily split Fe in the blood serum was noted in combination with hypochromic anemia and trophic disturbance. In a survey of individuals who were in contact with various forms of ionizing irradiation, in 72% of the cases a reduction in Fe content was found within a range of 15 to 45 gamma %. It is believed that under the effect of prolonged small doses of irradiation there is a serious disturbance in Fe metabolism. (Referativnyy Zhurnal, Biologicheskaya Khimiya, No. 16, Aug. 1963)

8225 SOME CLINICO-HEMATOLOGICAL AND BIOCHEMICAL CHANGES IN THERAPY OF RADIATION SICKNESS. N. K. Sviridov and G. N. Elpat'ebskaya. p.164-8 of "Rentgeno-Radiologiya Radiobiologiya i Dozimetriya." Moscow, 1962.

Dogs were irradiated with a dose of 600 roentgen ($LD_{80/30}$) inducing a severe or moderate degree of acute radiation sickness. After irradiation, the animals were given butyl alcohol (in a month) and leucogen (for 2-2.5 months) in a dose of 2 × 0.02 grams/day. Beginning from the 6th-7th day after irradiation, the animals were also given 1 tablet of caferid twice a day for 2-2.5 months. During the first 10 days the dogs received 2 × 100000 units of biomycin and then for 10 days 2 × 0.25 grams/day of levomycetin. The clinical symptoms of radiation sickness in the treated animals compared with control were less pronounced. In the untreated animals the concentration of readily labile iron was reduced down to one-half in a day, and by 3-5 days rose sharply due to hemolysis of the erythrocytes. The subsequent new drop (15-20%) coincided in time with the death of the animals. In the treated animals the fluctuations were less pronounced. Hypoproteinemia was noted in the course of radiation sickness — the total protein content was 6.2-6.4% with a drop in the A/G ratio. (Referativnyy Zhurnal, Biologicheskaya Khimiya, No. 14, July 1963)

8226 CHANGES IN PROPERDINE TITER AND SURVIVAL OF ANIMALS WITH ACUTE RADIATION SICKNESS. N. M. Ivanova, K. N. Klimova, and G. A. Gankevich. p.299-310 of "Voprosy Perelivaniya Krovi i Klinicheskoi Meditsiny." Kirov, USSR, 1962.

Healthy mice and rabbits received single intravenous injections of 5–25 milligrams per kilogram of bacterial polysaccharides (BPS; zimozan No. 3, 4, 10) or 10 gamma per kilogram of fermentary or bacterial lipopolysaccharides (LPS). Radiation sickness was produced by roentgen irradiation (RI), 500–1000 roentgen units. Administration of BPS or LPS elicited a distinctly pronounced increase in properdin (P) content. RI causes a reduction in P production in relation to the radiation dosage. Prophylactic administration of BPS and LPS increased the animal survival rate and had a beneficial effect on P production in animals with radiation sickness. (Referativnyy Zhurnal, Onkologiya, No. 13, July 1963)

8227 ACETYLIZATION PROCESSES IN BONE MARROW AFTER GENERAL ROENTGEN IRRADIATION. V. N. Filippova and I. V. Seyts. p.326-30 of "Voprosy Perelivaniya Krovi i Klinicheskoi Meditsiny." Kirov, USSR, 1962.

After irradiation of rats, the bone marrow (BM) from the femur was suspended in saline with versen (0.1%). The acetylizing activity of BM cells, evaluated by the quantity of acetylized sulfanilamide in a suspension of BM cells was reduced four hours after irradiation. The number of BM cells does not change and represents $1.2 \cdot 10^8$ of the cells per milliliter. (Referativnyy Zhurnal, Biologicheskaya Khimiya, No. 16, Aug. 1963)

8228 EFFECT OF DIET CONTAINING QUALITATIVELY DIFFERENT COMPOSITION OF FAT ON THE COURSE OF RADIATION SICKNESS. M. F. Nesterin. Tr. 2-oi Vtoroi Nauchn. Konf. po Vopr. "Probl. Zhira v Pitanii," Leningrad, 1962, 270-4.

It is shown that upon irradiation of dogs by x rays the change in the secretory function of the intestines is more pronounced than that of the stomach and pancreas. Investigation of the effect of diets containing beef fat, sunflower oil, and arachidonic acid-enriched fat, revealed the distinctive normalizing action on the secretory function of intestines of a diet containing arachidonic acid-enriched fat, in which the remarkable increase in enterokinase content in the intestinal juice was observed. (Referativnyy Zhurnal, Biologicheskaya Khimiya, No. 14, July 1963)

8229 ROLE OF HISTAMINE IN RADIATION SICKNESS. E. I. Krichevskaya and G. V. Kapitonova. p.159-78 of "Sbornik, Gisto-Gematicheskie Bar'ery i Ioniziruyushchaya Radiatsiya." Moscow, Academy of Sciences USSR, 1963.

The possibility of protecting irradiated animals by their previous depletion with respect to histamine (I) evidences the participation of (I) in the emergence and development of radiation sickness. The preliminary administration of (I) also protects against the effect of ionizing radiation. The protective effect observed was not however the result

of the saturation of the organism by free biologically active (I), since the administered (I) rapidly disappeared from the blood and was deposited mainly in the bound form in the organs. Thus, both methods of defense according to their mechanism are possible, and do not contradict each other. Disturbance by ionizing radiation of the histaminopectic capacity of tissues was caused in the administration of (I) to already irradiated animals by the accumulation in the organs of a large quantity of free (I). In the normal state in rats and mice the hematoencephalic barrier to (I) proved impermeable. Its breakdown under the effect of ionizing radiation in rats and the absence of the radiation effect in mice evidently was the cause of the different reaction of the animals to the administration of (I) upon irradiation. For the rise of toxicosis and rapid death of the irradiated animals given (I) obviously, not only is its accumulation in the free state in peripheral organs obligatory but also its penetration into the central nervous system. (Referativnyy Zhurnal, Biologicheskaya Khimiya, No. 14, July 1963)

8230 FIBRINOGEN CONTENT IN RAT BLOOD IN ACUTE RADIATION SICKNESS. H. A. Vargunin and V. M. Vargunina. p.117-19 of "Sbornik Nauchnykh Rabot po Klinichskoi Biokhimii." Krasnoyarsk, USSR, 1962.

In the blood of rats that died five to seven days after single general x irradiation (400–450 roentgen units) a decrease in fibrinogen content was noted, particularly in the agonal period. In the blood of animals that survived, 20 to 40 days after irradiation, the fibrinogen content was considerably elevated, then, as recovery progressed, it gradually dropped to normal. One of the prerequisites for survival and recovery of the rats from acute radiation sickness is an increase in fibrinogen content in the animals' blood. This is in agreement with the theory of fibrinization according to which an increase in fibrinogen content in the blood is a protective factor for an organism suffering from a number of diseases. (Referativnyy Zhurnal, Biologicheskaya Khimiya, No. 16, Aug. 1963)

Radiation Hazards and Protection

Refer also to abstract 8597.

8231 (AEC-tr-6049(p.271-8)) ESTIMATION OF DOSE FROM RADIOACTIVE CONTAMINATION. G. V. Yakovleva and V. P. Shvedov. (Translation)

Estimates are presented of the radiation dose to man from natural sources of radiation. Estimates are also presented for the predicted 30-year radiation dose to the population of various countries from fallout γ radiation from 1952 to 1956. The contributions of individual isotopes to the calculated value of the 30-yr γ dose were calculated. Emphasis was placed on the contribution of Sr^{90} and Cs^{137} to the total radiation dose. (C.H.)

8232 MEDICAL X-RAY EXPOSURE. Karl Z. Morgan (Oak Ridge National Lab., Tenn.). Am. Ind. Hyg. Assoc. J., 24: 588-99(Nov.-Dec. 1963).

Upon man's natural background exposure to ionizing radiation, modern uses of radioactive materials and radiation producing machines have superimposed further exposures. Added exposures through use of medical x-ray procedures can seriously exceed the tolerance levels. The severity of these hazards in the U.S.A. and elsewhere is discussed in relation to other exposures. Activities to control such hazards are summarized. (auth)

8233 THE BODY BURDEN OF LONG-LIVED ISOTOPES. Karl Z. Morgan (Oak Ridge National Lab., Tenn.). Arch. Environ. Health, 8: No. 1, 86-99(Jan. 1964).

The biological effects of the exposure of man to ionizing radiation from both external and internal sources are discussed. Data are summarized on the exposure of the gonads, bone, and lungs of man from natural background radiation; the average exposure of man to radiation from the natural background, medical uses, and fallout as of 1961; and the presently recommended permissible dose to body organs of occupational workers exposed to ionizing radiation. Problems and methods used in establishing the radiation dose for internal exposure are discussed. (C.H.)

8234 WHAT IS A PERMISSIBLE DOSE? E. E. Pochin (University Coll., London). Health Phys., 9: 1091-4(Dec. 1963).

Discussion is presented on permissible doses under various conditions. It is stressed that there is a very wide range of the levels of hazard in different existing industries. However, levels of permissible population exposure that are the lowest ones necessitated by the processes involving the exposures, and yet are justified, or more than justified, by the needs for these processes can be hoped for. (P.C.H.)

8235 PHYSICAL ORIGIN AND DISPERSION OF RADIOIODINE. J. Z. Holland (Div. of Biology and Medicine, AEC, Washington, D. C.). Health Phys., 9: 1095-1103(Dec. 1963).

A review is presented on the production, properties, and dispersion of iodine isotopes I^{117} through I^{140}. Special attention is given to I^{131}. (P.C.H.)

8236 PATTERNS OF I^{131} LEVELS IN PASTEURIZED MILK NETWORK. A. H. Dahl, R. Bostrum, R. C. Patzer, J. C. Villforth (Public Health Service, Washington, D. C.). Health Phys., 9: 1179-85(Dec. 1963).

The Public Health Service Pasteurized Milk Network (PMN) record from 62 stations covering all states since September 1961, following resumption of atmospheric testing shows that I^{131} levels in pasteurized milk have reached the lower values in Range III of Federal Radiation Council guidance for peacetime uses of atomic energy. Five special case studies of localized peaks are discussed briefly, including those that occurred in the fall of 1961: in Wichita, Kansas—May 1962; Salt Lake City, Utah—July 1962, Texas—November and December 1962; and Palmer, Alaska—1961–1963. Use of PMN milk data and related observations from air and precipitation surveillance for alert or assessment purposes are discussed briefly. (auth)

8237 COMPARISON OF INGESTION TO INHALATION DOSE TO MAN FROM I^{131}. G. Wehmann (Idaho Operations Office, AEC). Health Phys., 9: 1221-2(Dec. 1963).

Evidence obtained at the National Reactor Testing Station (NRTS) confirmed that the dose resulting from ingestion of I^{131} through the milk cycle can be at least two orders of magnitude greater than by the inhalation route following a contamination event involving a gaseous release over a farming area. With the lowering of the radiation protection guides for the thyroid in 1961, operations involving the planned release of I^{131} over off-site farming areas must be carefully followed. (P.C.H.)

8238 ESTIMATION OF THE DISTRIBUTION OF THYROID DOSES IN A POPULATION EXPOSED TO I^{131} FROM WEAPONS TESTS. M. Eisenbud, B. Pasternack, G. Laurer, Y. Mochizuki, M. E. Wrenn, L. Block, and

R. Mowafy (New York Univ., New York). Health Phys., 9: 1281-9(Dec. 1963).

The mathematical relationships that determine the distribution of thyroid doses in an exposed population are discussed, along with the feasibility of undertaking such calculations based on both existing data and data yet to be obtained. (P.C.H.)

8239 VARIABILITY OF THE I^{131} CONCENTRATIONS IN THE MILK DISTRIBUTION SYSTEM OF LARGE CITY. M. Eisenbud, B. Pasternack, G. Laurer, and L. Block (New York Univ., New York). Health Phys., 9: 1303-5 (Dec. 1963).

Late in 1962, when dairy products in New York City were contaminated with I^{131} from U.S.S.R. nuclear tests then in progress, studies were made of the variability of the I^{131} content of the milk from twenty-one of the milk processing plants in New York City. The measurements, which were made on 4 separate days, indicate that the variations from dairy to dairy were random in nature and that at the end of an extended period of sampling, such as 1 month, the mean concentrations of the milk from the various dairies would not have been significantly different from each other. It was concluded that during the period when the studies were conducted, the practice of analyzing single daily random samples of the milk of New York City provided a satisfactory estimate for the milk supply as a whole. (auth)

8240 PROPHYLACTIC AND THERAPEUTIC MEASURES FOR RADIOIODINE CONTAMINATION. A REVIEW. F. W. Lengemann and J. C. Thompson, Jr. (Div. of Biology and Medicine, AEC, Washington, D. C. and New York State Veterinary Coll., Ithaca, N. Y.). Health Phys., 9: 1391-7 (Dec. 1963).

Methods for preventing the movement through the food chain of the major portion of I^{131} resulting from fallout are reviewed. The methods consist primarily of the use of aged cattle feeds and stored milk. Compounds such as I^-, ClO_4^-, thiouracil, and carbimazole can be used to block the uptake of iodine by the thyroid in situations where these methods cannot be put into operation or where contamination is not through the food chain. (P.C.H.)

8241 SPECIAL EDITORIAL: BIOMEDICAL CONSIDERATIONS IN ACCIDENTAL RELEASES OF RADIOIODINE. Karl Z. Morgan (Oak Ridge National Lab., Tenn.). Health Phys., 9: 1423-6(Dec. 1963).

Maximum permissible dose and hazards of radioiodine exposures are discussed. Special consideration is given to radioiodine exposure through milk. (P.C.H.)

8242 CONSIDERATIONS ON PROBLEMS OF PROTECTION AGAINST X RAYS DURING FLUOROSCOPY AND RADIOGRAPHY. Isidore G. Gounaris. J. Radiol., Electrol. Med. Nucl., 44: 735-8(Nov. 1963). (In French)

The various radiation sources that may act on living beings and the variability of the tolerance doses according to various Commissions and Committees are discussed. Determinations were made at various levels of the human body during fluoroscopy and radiography, using precise constants. It appears that for reducing the irradiation dose, the diaphragm opening plays an important role and also the addition of a 2 mm Al filter. Under such conditions, there exist no risks of serious ovarian lesions, a fact demonstrated by Kaplan. It is necessary for the safety of the roentgenologist to check the protection given by his machine by performing determinations, so that the radiation absorbed weekly does not exceed 100 mr. (auth)

8243 RADIOCHEMISTRY AND REMOVAL CHARACTERISTICS OF RADIUM ISOTOPES IN IOWA WELL WATERS. R. L. Morris and J. W. Klinsky (State Hygienic Lab., Iowa City, Iowa). Proc. Iowa Acad. Sci., 69: 396-9 (1962).

Significant concentrations of Ra^{226}, a naturally occurring isotope which has no relationship to fallout, were detected in a number of deep wells in Iowa. Wells that have significant radium concentrations are located in smaller communities mostly in southeastern part of the state. Several of the towns have municipal zeolite softening processes which remove radium down to low levels. In some cases where the raw well water shows relatively high concentrations, zeolite-softened water distributed to the public has had approximately 90% of the radium removed. Wells tested so far show that the average radium values are in most instances within the range specified by the Federal Radiation Council. (auth)

8244 DETECTION AND MEASUREMENT OF AIRBORNE RADIATION AT GRINNELL, IOWA. Michael P. Schulhof and James Wolfson. Proc. Iowa Acad. Sci., 69: 446-50(1962).

A method is presented for the detection and measurement of total air-borne radiation. It employs only a scintillation counter, and ordinary laboratory materials. Using this method, a monitoring station was established for the period from the fall of 1961 through the spring of 1962. The results from this study, when compared with the results published by the United States Public Health Service, indicated a high degree of reliability in the method used. (auth)

8245 POLONIUM-210: A VOLATILE RADIOELEMENT IN CIGARETTES. Edward P. Radford, Jr. and Vilma R. Hunt (Harvard School of Public Health, Boston). Science, 143: 247-9(Jan. 17, 1963).

Polonium-210, which emits alpha particles, is a natural contaminant of tobacco. For an individual smoking two packages of cigarettes a day, the radiation dose to bronchial epithelium from Po^{210} inhaled in cigarette smoke probably is at least seven times that from background sources, and in localized areas may be up to 1000 rem or more in 25 years. Radiation from this source may, therefore, be significant in the genesis of bronchial cancer in smokers. (auth)

8246 RADIATSIONNAYA GIGIENA. TOM I. GIGIENA TRUDA. (Radiation Hygiene. Vol. I. Sanitation of Labor). S. M. Gorodinskii, G. M. Parkhomenko, and N. Yu. Tarasenko, eds. Moscow, Medgiz, 1962. 231p.

The book is divided into five parts each treating a phase of radiation hygiene and personnel protection. The first chapter deals with ionizing radiation effects on human organism, the second with problems of protecting personnel handling radioactive materials and radiation sources, the third is concerned with decontamination techniques, and the fourth and fifth chapters consider dosimetric control and shielding. Extensive bibliographies are included. (R.V.J.)

8247 GIGIENA TRUDA PRI RABOTE S POLONIEM. (Industrial Hygiene in Handling Polonium). G. M. Parkhomenko. [Moscow], Gosatomizdat, 1963. 52p.

Properties and biological effects of polonium are described, and various prophylactic and protective measures are suggested for personnel handling polonium. (R.V.J.)

8248 DERIVED "MAXIMUM PERMISSIBLE LEVELS" USED IN NEIGHBOURHOOD AND WORKING ENVIRONMENT SURVEYS. H. J. Dunster and R. J. Garner (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). 10p. (CONF-365-1)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The interpretation of measurements and calculation of derived working limits in environmental surveys is discussed. Interpretation of the results of environmental surveys in terms of ICRP recommendations or statutory requirements is stressed. To illustrate the wide range of applications in which DWLs have proved useful, and to give some indication of the limits of their applicability, a number of values in use in the UKAEA is summarized. The concept of derived working limits can be used with great effect in the interpretation of environmental survey results provided that their inherent inaccuracies are remembered and provided that they are not used in conditions for which they were not intended. (P.C.H.)

8249 THE PRE-OPERATIONAL DISTRICT SURVEY AT HUNTERSTON. G. Jackson (Hunterston Nuclear Generating Station, Eng.). 18p. (CONF-365-22)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Results are given of the pre-operational district survey at Hunterston which was conducted to determine the activity levels in foodstuffs and other materials prior to operation. The results include Sr^{90}, Sr^{89}, Cs^{137}, and I^{131} in milk, herbage, root mat, soils and reservior water, and gamma surveys. These measurements were made over a period of time of a year before operation, but it is felt that single measurements taken immediately prior to reactor commissioning would have sufficed. (D.L.C.)

8250 THE G.E.C. DISTRICT SURVEY OF THE HUNTERSTON AREA. D. J. Mathias. 11p. (CONF-365-23)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

A district survey of the Hunterston area was conducted from Feb. 1959 to Nov. 1961, and it included gamma background and radioactivity of biological samples. The summarized results include the beta activities of rushes, grasses, seaweed, milk, and fish. Rushes were found to concentrate fission product fallout in rainfall to a high degree. It is felt that a routine district survey is not necessary to the safe operation of a nuclear power station. (D.L.C.)

8251 PROBLEMS IN THE ACHIEVEMENT OF OPTIMAL RADIATION LEVELS IN HOSPITAL PRACTICE. R. E. Ellis (Middlesex Hospital, London). 10p. (CONF-365-9)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Working levels around typical apparatus and sources in a hospital, which include diagnostic x-ray apparatus, therapeutic apparatus, sealed radioactive sources, and unsealed radioactive materials, are discussed together with some of the outstanding protection problems in the departments. (P.C.H.)

Radiotherapy and Radiodiagnosis

8252 (VDIT-79) Ir^{192} AND Ir^{194}. SOME NUCLEAR CHARACTERISTICS FOR APPLICATION IN RADIOTHERAPY. A Literature Survey. Anders Nystroem (Aktiebolaget Atomenergi, Studsvik, Sweden). Nov. 1963. 17p.

Twenty-nine abstracts are presented on nuclear characteristics of Ir^{192} and Ir^{194} for application in radiotherapy. (C.H.)

8253 (NP-tr-1087) BETA DOSIMETRY IN INTERSTITIAL APPLICATIONS. J. Dutreix. Translated by P. E. Crampton (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.), from J. Radiol. Electrol. Med. Nucl., 41: 731-45(1960). 57p.

Problems and methods of β dosimetry in interstitial applications are described. Emphasis is placed on dose measurements from Y^{90} and P^{32} sources used for therapy, when the Y^{90} is in the form of seeds and the P^{32} in the form of drops. Data are also included on the dosimetry of spherical seeds of Au^{198}. (C.H.)

8254 ISODOSE CURVES FOR COBALT-60 IRRADIATION. J. Halvas (Comision Nacional de Energia Nuclear, Mexico City). Com. Nacl. Energia Nucl. (Mex.), [Publ.], No. 129, 73-8(Oct. 1963). (In Spanish and English)

A method of clinical dosimetry that can be easily applied to studies in oncology is described. The source of gamma radiation used is a Theratron B of 1200 C Co^{60}. (auth)

8255 COLLOIDAL ZIRCONYL PHOSPHATE P 32 IN THE TREATMENT OF CHRONIC LEUKEMIA AND LYMPHOMAS. J. M. Hill, Ellen Loeb, and R. J. Speer (Wadley Research Inst., Dallas). J. Am. Med. Assoc., 187: 106-10(Jan. 11, 1964).

Colloidal zirconyl phosphate P^{32}, used as a preferred initial and long-term therapy, gave prolonged survival in 179 patients with chronic leukemia and lymphoma. A median survival time of 93.6 months from apparent onset of disease was obtained in 97 patients with chronic lymphocytic leukemia. For chronic myelogenous leukemia, lymphosarcoma, and Hodgkins disease, corresponding survival figures were 49.8 months, 59 months, and 25.7 months, respectively. The digital computer was used to calculate survival times. Radiocolloid zirconyl phosphate is recommended for therapeutic effectiveness related to the concentration of irradiation at the sites of leukemic and lymphomatous infiltrations. (auth)

8256 RADIOIODIDE SPACE IN HUMAN SUBJECTS WITHOUT EDEMA. T. H. Oddie, D. A. Fisher, J. C. Wait, and B. Newtown (Univ. of Arkansas Medical Center, Little Rock). J. Clin. Endocrinol. Metab., 24: 54-9(Jan. 1964).

The radioiodide space was measured in groups of subjects, including infants, children, and adults. Regression analyses were performed to relate the volume of the iodide space, at different times after injection of the test dose of radioiodine, with the weight of the patient. (auth)

8257 A METHOD FOR MAINTENANCE OF CURIE QUANTITIES OF Y^{90}-DTPA IN THE HUMAN BODY FOR DEFINED TIME PERIODS: TECHNIQUE AND DOSIMETRY. H. S. Winchell, M. Pollycove, W. D. Loughman, and J. H. Lawrence (Univ. of California, Berkeley). J. Nucl. Med., 5: 16-26(Jan. 1964).

A procedure is described by which a radioactive isotope may be maintained at a constant level within the body for a specified period followed by rapid removal of the isotope from the body under controlled conditions. The particular isotope used in these experiments was yttrium-90 chelated with DTPA. The procedure lends itself to use with any radioactive isotope which is either quantitatively excreted by the kidneys or which can be attached firmly to a suitable chelating agent that is rapidly cleared from the body by the kidneys. The methods and equipment necessary for continuous processing and intravenous recycling of urine containing high concentrations of a radioisotope are described. A method for estimating dosimetry is presented for injected Y^{90}-DTPA which is in equilibrium with plasma.

However, this method has general applicabilities for any β or α emitting isotope used in the manner described. (auth)

8258 [Hg^{197} AS SCANNING NUCLIDE.] D. Bruce Sodee (Walter Reed General Hospital, Washington, D. C.). J. Nucl. Med., 5: 74-5(Jan. 1964).

The physical characteristics of Hg^{197} are discussed, and calculations of the radiation dosimetry involved with the radiopharmaceutical Hg^{197}-Neohydrin are presented. Using whole-body counts the effective half life of Hg^{197}-Neohydrin in the body was calculated to be 0.23 days. The renal retention of Hg was found to be approximately 10% and the radiation dose to the kidneys is 4.37 rads per one millicurie patient dose. (P.C.H.)

8259 EXPERIENCES WITH THE METHODOLOGY OF THE IN VITRO DIAGNOSTIC RADIOACTIVE IODIDE TEST. Laszlo Kertesz and Ferenc Peter (Nuclear Research Inst., Hungarian Academy of Sciences, Debrecen and Medical Univ. of Debrecen, Hungary). Kiserl. Orvostud., 15: 497-502(Oct. 1963).

The Hamolsky test, a simple, reproducible method is described. Valuable diagnostic information can be obtained by this method about thyroid function, without exposure to radiation. During pregnancy, in immature and mature infants, the behavior of the thyroid hormone-binding proteins of the plasma should also be determined. The influence of hematocrit anomalies on the Thybon-uptake of the erythrocytes can be corrected for by the introduction of the Adams' coefficient. (OTS)

8260 ROENTGEN IRRADIATION IN THE TREATMENT OF HYPERTHYROIDISM. Hideo Irie and Keiichiro Onizuka (Kyushu Univ., Japan). Nippon Igaku Hoshasen Gakkai Zasshi, 23: 786-91(Sept. 1963). (In Japanese)

For the treatment of hyperthyroidism, external x-ray irradiation of the gland was adopted. Tangential technique was used, and 50 r was given initially and increased until it reached 100 to 159 r. Frequency of irradiation was once a week. The basal metabolic rate as well as the iodine uptake of the thyroid gland were repeatedly measured to prevent the development of hypothyroidism. Usually therapy was discontinued when the basal metabolic rate dropped to +20% value. Nineteen cases of hyperthyroidism were treated by this external irradiation technique. Nine of them became euthyroid. Eight were still in hyperthyroidism but showed remarkable improvement. One case had no change. There was no case of hypothyroidism and neoplasm after this external therapy. Recurrences were seen in 2 cases. (auth)

8261 INFLUENCE OF THE RADIATION SOURCE-AXIS AND RADIATION SOURCE-DIAPHRAGM DISTANCES ON THE RELATIVE DOSE DEPTH FOR ROTATIONAL IRRADIATION WITH Co^{60}. Iwao Azuma, Gunther Barth, and Felix Wachsmann (Universität, Giessen, Ger. and Universität, Erlangen, Ger.). Strahlentherapie, 122: 519-30(Dec. 1963). (In German)

Measurements about the ratio of surface dose to dose in the axis in case of rotational irradiation as function of source-axis and source-diaphragm distance are reported. Phantom diameters of 18, 24, and 30 cm and focus field sizes between 3×6 and 8×16 cm were used for these measurements. The different influences were very complex and often difficult to understand. The relative surface dose does not depend greatly on the geometrical conditions chosen. In regard to a high dose rate it is recommended that a source-axis distance of about 60 cm and a source-diaphragm distance of about 30 cm be chosen for the rotational irradiation with Co^{60}. (auth)

8262 FACTORS FOR CONSIDERATION OF NON-WATER-EQUIVALENT TISSUES FOR RADIATION BETWEEN 200 kev AND 17 Mev. Hans Ludwig Keller and Sam Rok Je (Universität, Erlangen, Ger.). Strahlentherapie, 122: 531-41(Dec. 1963). (In German)

Tissue factors for conventional radiation with a HVL (half-value layer) of 1 and 4.2 mm Cu, for Co^{60} radiation, and for ultrahard x rays (17 Mev) were determined for the cranium, the thoracic space, and for the abdomen-pelvic area. The results were obtained by measuring the exit dose in patients and are given in graphs. All body tissues are more water equivalent with increasing radiation energy, that is the tissue factors approach a value of 1. Therefore, the individual scattering of the tissue factors becomes smaller for higher energies, too. A considerable gain in accuracy can be obtained sometimes by considering the irradiated body tissue as not water equivalent, e.g., by the use of a mean tissue factor or by the determination of an individual tissue factor in each irradiation case. (auth)

8263 APPARATUS FOR THE DEEP-SEATED IRRADIATION OF THE HUMAN BODY WITH FAST ELECTRONS. R. Wideroee and M. Sempert (to Brown, Boveri & Cie, AG). German Patent 1,154,881. Sept. 26, 1963. Priority date July 24, 1959, Switzerland.

The apparatus described contains a focusing magnetic lens and a cut-out shield, both of which rotate together around the axis of the beam. The cut out of the shield is essentially directed radially and encloses the focused magnetic field. (Gmelin Inst.)

CHEMISTRY

General

8264 (NBL-204) SEMIANNUAL PROGRESS REPORT [ON CHEMISTRY] FOR THE PERIOD JANUARY 1963 THROUGH JUNE 1963. (New Brunswick Lab., AEC, N. J.). Dec. 1963. 76p.

Research progress in chemistry is reported under 15 topics. Separate abstracts were prepared for 13 of the sections. In the remaining sections preparation of high-purity potassium fluoborate and determination of Th^{230} in Th^{232} using a solid-state detector are discussed. (M.C.G.)

For abstracts of individual sections see: 8272, 8273, 8274, 8275, 8276, 8277, 8278, 8279, 8327, 8328, 8329, 8611, and 9314.

Analytical Procedures

Refer also to abstracts 8519, 8642, and 9584.

8265 (AE-128) OPTIMIZATION IN ACTIVATION ANALYSIS BY MEANS OF EPITHERMAL NEUTRONS. DETERMINATION OF MOLYBDENUM IN STEEL. D. Brune and K. Jirlow (Aktiebolaget Atomenergi, Stockholm). Dec. 1963. 13p.

Optimization in activation analysis by means of selective activation with epithermal neutrons is discussed. This method was applied to the determination of molybdenum in a steel alloy without recourse to radiochemical separations. The sensitivity for this determination is estimated to be 10 ppm. With the common form of activation by means of thermal neutrons, the sensitivity would be about one-tenth of this. The sensitivity estimations are based on evaluation of the photo peak ratios of Mo^{99}/Fe^{59}. (auth)

8266 (CEA-Bib-36) DETERMINATION DE L'OXYGENE DISSOUS DANS L'EAU. APPLICATION AU DOSAGE DES FAIBLES TENEURS EN OXYGENE DISSOUS. ETUDE BIBLIOGRAPHIQUE. (Determination of Oxygen Dissolved in Water. Application to the Measurement of Small Quantities of Dissolved Oxygen. A Bibliographic Study). R. Roumy (France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1963. 27p.

A brief review and a classification are given of the various methods used for dosing oxygen dissolved in water, with particular reference to the case of low concentrations. Eighty-five bibliographic references are given classified according to these methods. The fundamental articles and those giving the precautions necessary are listed. The case of the measurement using orthotolidine is considered, this being the method standardized in France. (auth)

8267 (CONF-151-4) TRACE ELEMENT DETERMINATIONS IN NATURAL MATERIALS BY ACTIVATION ANALYSIS. William D. Ehmann (Kentucky. Univ., Lexington). [1963]. Contract AT(40-1)-2670. 22p.

From 19th International Union of Pure and Applied Chemistry Congress, London, July 1963.

Abundances of zirconium, hafnium, cadmium, antimony, tantalum, gold, platinum, and iridium have been determined in meteorites, tektites, deep-sea sediments, and various terrestrial materials by use of neutron activation analysis. Among the principal advantages of the method are its high sensitivity and freedom from errors due to reagent and laboratory contamination. These data have considerable significance in the fields of geochemistry and cosmochemistry. Each of these elements, except platinum, is separated after irradiation from the sample matrices by use of carriers and specific radiochemical separation techniques. Gold and platinum are determined simultaneously by separating and counting only gold. This is possible due to the decay of the irradiation-produced Pt^{199} to its radioactive daughter, Au^{199}. Gamma-ray scintillation spectrometry allows selective counting of the Au^{198} produced from the irradiation of gold and the Au^{199} produced indirectly from the irradiation of platinum in the samples. All abundances are computed by comparison of gamma-ray counting rates of the extracted samples with the counting rates of standard samples of each element irradiated simultaneously. Certain of the abundance data for chondritic meteorites as determined in this work, including zirconium at 34 ppm, gold at 0.22 ppm, iridium at 0.49 ppm, and tantalum at 0.02 ppm, are in good agreement with the relatively few previous determinations found in the literature. However, other abundances, such as hafnium at 0.19 ppm in chondrites, are substantially different from previously reported data. The significance of these data as related to theories of meteorite formation and nucleosynthesis in the stars is briefly discussed. (auth)

8268 (EUR-432.f) DETERMINATION AU MOYEN DE L'ANALYSE PAR ACTIVATION AUX NEUTRONS DES IMPURETES PRESENTES A L'ETAT DE TRACES DANS DES MATERIAUX ORGANIQUES. (Determination of Trace Impurities in Organic Materials by Neutron Activation Analysis). G. Girardi and J. Pauly (European Atomic Energy Community. Nuclear Research Center, Ispra, Italy). 1963. 24p. (CONF-151-3)

From XIXth International Union of Pure and Applied Chemistry Congress, London, July 1963.

Neutron activation analysis has been applied to hydrocarbons and plastics. The impurities detected can be divided into two groups, those homogeneously distributed as organic or metallorganic compounds and those contained as particles in suspension. Inorganic elements generally belong to the first group. The halogens, As, and Sb, are determined in a nondestructive manner by gamma ray spectrometry. For oxygen two methods by reactor neutron irradiation have been tried, but the sensitivity obtained was rather low. Better results have been obtained by using 14 Mev neutrons and measuring the amount of nitrogen-16 produced by (n,p) reaction. For the determination of sulphur, different reactions have also been studied and interferences produced by neighboring elements evaluated. Metallic impurities are generally bound to particles in suspension. Many of them can be analysed by nondestructive methods, but oxidation of the organic compound and chemical separation are often useful to increase selectivity. Different methods of oxidation have been investigated and the reasons of the possible losses studied. Procedures in which the results are calculated by means of an electronic computer IBM 7090 have been developed. It is thus possible to apply activation analysis for the routine control of impurities in long range experiments on the organic heat exchangers used in nuclear technology. (auth)

8269 (HW-63985) REDOX DISSOLVER OFF-GAS MONITOR — CALIBRATION AND TEST. C. E. Huck (Gen-

eral Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 4, 1960. Contract AT(45-1)-1350. 25p.

A prototype off-gas analyzer system consisting of a thermal conductivity cell and a combustible gas analyzer was developed for use in Redox dissolution processes. The analyzer system was calibrated in the laboratory and is now installed on the Redox B2 dissolver off-gas line. Calibration data were obtained for the following gas mixtures: hydrogen in air, hydrogen in ammonia and air, hydrogen in oxides of nitrogen and air, and ammonia in hydrogen and air. Precision of readings ranged from ±3% of full scale for a simple hydrogen air mixture to ±6% of full scale for mixtures of 3 or more gases. Response time of the system is about 3 minutes. (auth)

8270 (HW-74555) A COMPARISON OF ARSENIOUS OXIDE AND PLUTONIUM FOR THE STANDARDIZATION OF CERIC SULFATE. P. F. Raney (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 6, 1962. Contract AT(45-1)-1350. 6p.

The use of arsenious oxide in the macro standardization of ceric sulfate solutions used in plutonium assay is being proposed. To check this new method, macro standardizations of 0.1 N ceric sulfate solutions were carried out using both arsenic oxide and plutonium metal. The results show that the plutonium method has a significantly larger standard deviation than the arsenic oxide method, and hence the latter method is a better reference. Possible explanations of the irregular plutonium results are given. (D.L.C.)

8271 (KAPL-M-SLJ-10) THE DETERMINATION OF BORON IN STAINLESS STEEL. THE USE OF MIXED-BED ION EXCHANGE. S. L. Jones and V. F. Consalvo (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 27, 1963. Contract W-31-109-eng-52. 39p.

A procedure is presented for the determination of boron in stainless steel in the 0.1 to 2% boron range. After dissolution of the sample, almost all interfering substances are removed by passage through a mixed bed ion exchange resin column. Carbon dioxide is then removed by gentle boiling, and the boric acid present is titrated directly with standard sodium hydroxide using the mannitol procedure. Boric acid is used as a primary standard for boron. At about 1% boron the coefficient of variation is ±0.3%. (auth)

8272 (NBL-204(p.9-11)) ANALYSIS OF POTASSIUM FLUOBORATE. H. Zibulsky and J. S. Paller (New Brunswick Lab., AEC, N. J.).

Two methods of analysis were investigated for determining the purity of potassium fluoborate. One method determines the fluorine gravimetrically as CaF_2 and the other method consists of titrating boric acid with sodium hydroxide in the presence of mannitol. (auth)

8273 (NBL-204(p.21-3)) DETERMINATION OF U^{235} BY GAMMA-RAY SPECTROMETRY. COMPARISON DATA USING AUTOMATIC SAMPLE CHANGER. L. C. Nelson, Jr. (New Brunswick Lab., AEC, N. J.).

Data comparing gamma spectrometric results with mass spectrometric values for samples in the ranges of 2.5 to 11.8% of U^{235} and 88 to 93% U^{235}, using an automatic sample changer and a "Spectrostat" count-rate-difference-feedback system, are presented. An improvement in precision and reliability and a reduction of man-hour requirements were realized. (auth)

8274 (NBL-204(p.25-7)) COMPARATIVE RESULTS OF THE DETERMINATION OF URANIUM-235 BY NEUTRON ACTIVATION AND MASS SPECTROMETRY. H. Bussell (New Brunswick Lab., AEC, N. J.).

Comparative results are given for the determination of U^{235} by neutron activation and mass spectrometry on nineteen samples of various enrichments. (auth)

8275 (NBL-204(p.33)) PREPARATION OF U_3O_8 FROM ENRICHED URANIUM SCRAP SOLUTIONS. J. S. Paller (New Brunswick Lab., AEC, N. J.).

A method is described for the preparation of U_3O_8 from enriched uranium scrap solutions for mass spectrometric analysis. (auth)

8276 (NBL-204(p.35-40)) POTENTIOMETRIC DETERMINATION OF PLUTONIUM WITH POTASSIUM DICHROMATE: VOLUMETRIC SAMPLING EVALUATION. C. E. Pietri and A. W. Wenzel (New Brunswick Lab., AEC, N. J.).

The precision obtained for the plutonium assay method using a volumetric sampling procedure on two standard solutions is ±0.08% as compared to previous results of 0.01 to 0.04% for gravimetric sampling of varied types of material. Average experimental values obtained were the same for one standard but significantly higher for the second standard. A possible effect of the order of pipetting and order of analysis on the results of the plutonium assay was noted. The measured values of specific gravity and plutonium assay differed from "accepted" values. (auth)

8277 (NBL-204(p.59-64)) PREPARATION OF STANDARD PLUTONIUM SOLUTIONS FOR ALPHA COUNTING. C. E. Pietri (New Brunswick Lab., AEC, N. J.).

Two methods, volumetric and gravimetric, are described for the preparation of standard plutonium solutions for alpha counting following removal of interfering Am^{241} by anion-exchange separation. The absolute maximum error associated with the volumetric method is estimated to be within 0.4 to 0.5% while that for the gravimetric procedure is within 0.1%. Calibration of an alpha counter with a standard plutonium solution gave an efficiency factor, at the 95% confidence level, of 49.91 ± 0.57% while an americium source calibrated by coincidence counting gave 49.6 ± 0.2%. (auth)

8278 (NBL-204(p.65-9)) EMISSION SPECTROGRAPHIC ESTIMATION OF AMERICIUM IN PLUTONIUM. A. W. Wenzel and C. E. Pietri (New Brunswick Lab., AEC, N. J.).

A method for the emission spectrographic estimation of americium in plutonium was developed. The method is quantitative in the 10 to 120 ppm range and estimations may be made in the rest of the 1 to about 200 ppm range. Greater sensitivity was obtained when standards were processed in 1N HNO_3 instead of 8N HNO_3. (auth)

8279 (NBL-204(p.71-3)) SPECTROCHEMICAL DETERMINATION OF BORON IN PLUTONIUM AND URANIUM FOLLOWING CATION-EXCHANGE SEPARATION. A. W. Wenzel and C. E. Pietri (New Brunswick Lab., AEC, N. J.).

The development of an emission spectrographic method was continued for the determination of boron following ion-exchange separation of plutonium and uranium. Mannitol was used to prevent volatilization losses of boron during evaporative concentration of the boron-rich effluent. The use of zinc as an internal standard for the determination of boron is described. Results using boron-spiked plutonium and uranium solutions showed essentially quantitative recovery in the 3 to 30 ppm range. (auth)

8280 (NBL-205) INVESTIGATION OF THERMIONIC EMISSION ION SOURCES FOR THE ISOTOPIC ANALYSIS

OF LITHIUM. H. O. Finley and J. J. Pucilowski, Jr. (New Brunswick Lab., AEC, N. J.). Dec. 1963. 13p.

A mass-spectrometric procedure using a triple-filament, thermal-emission ion source for the analysis of lithium was developed. Five portions of an isotope reference sample No. 9 (NBS) of lithium carbonate were converted to the nitrate form and analyzed using two types of ion sources and two sample holders. It was found that a triple filament ion source with a 0.005-in.-diameter tungsten wire as an ionizing filament and a 0.060 in. wide, $^{11}/_{16}$ in. long, and 0.008 in. thick Nichrome sample holder is the most desirable. A steady ion current is achieved in about fifteen minutes. The precision of the measured atom % Li^6 is 0.018 (standard deviation). The standard deviation between charges is 0.05. (auth)

8281 (NYO-4700(Rev.)) HEALTH AND SAFETY LABORATORY MANUAL OF STANDARD PROCEDURES. (New York Operations Office. Health and Safety Lab., AEC). Mar. 1957. Revised, Aug. 1962. 454p.

Analytical methods used currently by the Analytical Branch of the Health and Safety Laboratory, U. S. Atomic Energy Commission are presented. The methods were developed or modified primarily for use in the analysis of various samples for total radioactivity and specific fallout fission products. Procedures are included for the analysis of breath for radon and the determination of Be in various materials. Radiochemical methods are described for the determination of mixed fission products, U, Th, Ra^{224}, Ra^{228}, Rn^{222}, Pb^{210}, W^{185}, Ce^{141}, Ce^{144}, Pr^{144}, Ba^{140}, Cs^{137}, Y^{91}, Sr^{89}, and Sr^{90} in tap water, rain water, sea water, urine, filter samples, tissue, vegetation, powdered milk, liquid milk, and foods. Many of the fundamental properties of radiation are discussed. Certain conversion formulas that are convenient for handling radiochemical data are included. (C.H.)

8282 (PG-Report-497) ANALYTICAL METHOD FOR THE SPECTROGRAPHIC DETERMINATION OF LITHIUM, POTASSIUM, AND BARIUM IN URANIUM ORES AND CONCENTRATES BY THE CARRIER DISTILLATION METHOD. (United Kingdom Atomic Energy Authority. Production Group, Springfields, Lancs, England). 1963. 21p.

The ore or concentrate after ignition is diluted with spectrographically pure U_3O_8 and mixed with 7% by weight of sodium chloride carrier. The mixture is placed in a graphite cup which is made the anode for excitation in a d-c arc at 12 amp. Spectra are recorded photographically using a large spectrograph with either glass or quartz optics. Direct emission from the electrodes is avoided by use of an electrode screen. Spectra are evaluated visually or by microphotometer. The method is suitable for the determination of Li from 0.1 ppm upwards, Ba from 1 ppm upwards, and K from 10 ppm upwards, with respect to uranium in the appropriate dilution of the sample. Limits of detection with respect to sample are dependent on the total impurity content of the ore or concentrate. The precision is expected to be of the order of ± 50% (3 × sigma) within the ranges. (auth)

8283 (TID-7029) SELECTED MEASUREMENT METHODS FOR PLUTONIUM AND URANIUM IN THE NUCLEAR FUEL CYCLE. Ralph J. Jones, comp. and ed. (Division of Technical Information, AEC). 1963. 440p.

A handbook is presented of methods for the measurement of SS materials being transferred into or out of the AEC complex. General considerations in the analytical methods are given: standards, sampling, bulk measurements, and statistics. The methods include these for measurement of U concentration, U isotopic composition, Pu concentration, and Pu isotopic composition. Supplementary methods are also included. (D.L.C.)

8284 (TID-19994) MEASUREMENT OF TRITIUM; METHODS AND INTERPRETATION. Uriel Karfunkel (Weizmann Inst. of Science, Rehovoth, Israel). July 1961. Contract AT(30-1)-2166. 120p. (In Hebrew)

Thesis submitted to Israel Inst. of Tech., Haifa.

A description is given of a laboratory for measuring tritium at a natural level. The measurements are performed in the Geiger region and the gas phase. The enrichment is achieved by electrolysis. The system was planned for routine use, making measurements down to 0.5 T.U. concentration with ±20% accuracy possible. The proper selection of the measuring and enrichment method is discussed generally, estimating the relative weight of the different factors contributing to sensitivity and accuracy. This analysis is based on the "figure of merit" parameter, with special attention devoted to recent developments in counting and enrichment techniques. The relative importance of the different factors is also discussed according to their adaptability to routine measurements. A tentative conclusion from this analysis is that one can today use enrichment methods with low enrichment but a much better accuracy than that attained by electrolysis, if one exploits the experience gained in different laboratories in the construction of sensitive counters, achievement of low background, and efficient counter filling. Another unavoidable conclusion is that the measurement in the gas phase has been pushed almost to its practical optimum, while other methods still being developed can and will attain in the near future competitive sensitivity and greater convenience in operation. The enrichment by electrolysis follows conventional lines, with special attention to regular and stable working conditions. Thus reproducibility was improved to below 10% in many cases. Contamination problems which appeared in the electrolytic system as a result of the use of high tritium standards, led to instructive conclusions regarding memory in the electrolytic cells, a phenomenon not investigated hitherto with proper attention. An estimate is given of the extent of the memory, with far-reaching conclusions as to the enrichment of samples of very low tritium concentrations. Results of about 50 measured samples of rain falling in the period 1958–61 are given, followed by brief comments. Specially prominent is the stratospheric leak of Spring 1959 followed by the low levels in 1960 and the beginning of 1961. The analysis of the results was done only as far as necessary for accentuating those points directly connected to the problem of the natural production rate of tritium by cosmic radiation. Tritium from thermonuclear devices serves as a tracer for the investigation of world wide meteorological processes and the circulation of water in nature, and as such is a good means for illuminating many of the parameters pertinent to processes about which only little is known, and the estimate of which is vital for the proper understanding of the circulation of natural tritium. Conclusions from the measurements made in this work together with proper exploitation of knowledge gained in recent years by other workers today make possible a much deeper insight and understanding of the problem of the natural production rate of tritium. Already in 1957 Craig directed attention to the discrepancy of almost one order of magnitude between the natural production rate of tritium as estimated from known cross sections for tritium productions and cosmic ray flux, and natural production rate of tritium as obtained from the concentration measured in rains in periods free of hydrogen bombs. It seems that this discrepancy may be

explained almost in all approaches which lead to a too high production rate. Thus discrepancy is removed quantitatively in the case of determination of the production rate over the North-American Continent, but is explained only qualitatively for the oceanographical and arctic measurements, especially because of lack of good estimates for the parameters needed. One of the arguments in the case of oceanographical measurements was the low reliability in the measurements of low concentrations, and this argument is further supported by experience and a review of other measurements made in this field. Attempt was made to estimate other possible contamination sources, and it seems as if in extreme cases only, any significant effect of such sources could be realized. It is concluded that the evidence does not justify the postulation of extra-terrestrial processes for the production of tritium, although small contributions of this or some other unknown source may still be possible. (auth)

8285 (AEC-tr-6049(p.11-21)) PROCEDURE FOR DETERMINING THE TOTAL ACTIVITY OF FISSION PRODUCTS IN VARIOUS MEDIA. Z. G. Gritchenko. (Translation)

Methods are described for measurements of the total β and γ radioactivity from mixed fallout fission products in environmental samples. Emphasis is placed on the analysis of samples of air, precipitation, and soil. Counter calibration is also discussed. (C.H.)

8286 (AEC-tr-6049(p.22-46)) METHOD OF RADIOCHEMICAL ANALYSIS OF FISSION PRODUCTS. (Translation)

Methods are described for the radiochemical determination of fission products in environmental samples. The methods described include procedures for separation, isolation, purification, identification, and measurement of the content of the isotopes. Emphasis is placed on methods for the determination of Sr^{89}, Sr^{90}, Cs^{137}, Ce^{144}, Ru^{103}, and Ru^{106}. (C.H.)

8287 (AEC-tr-6049(p.47-74)) METHODS OF RADIOCHEMICAL ANALYSIS OF LONG-LIVED FISSION PRODUCTS IN SAMPLES FROM THE EXTERNAL ENVIRONMENT. (Translation)

Methods are described for the radiochemical determination of long-lived fallout fission products in environmental samples. Emphasis is placed on methods for the determination of Sr^{90}, Ce^{144}, and Cs^{137} in samples of air, rain water, sea water, soil, plants, and foods. (C.H.)

8288 (AEC-tr-6049(p.75-99)) PHYSICAL METHODS OF DETERMINING AND IDENTIFYING INDIVIDUAL ISOTOPES. (Translation)

Methods are described for the identification of individual radioisotopes from fallout fission products. Methods discussed in detail include the use of a scintillation γ spectrometer, the use of photographic film detectors, and methods based on the analysis of the γ and β absorption curves and decay curves of the isotopes and chemical identification. It is pointed out that most of the fallout fission products decay forming a radioactive isotope. Emphasis is placed on methods for the identification of Cs^{137}, Ru^{106}, Sr^{89}, Sr^{90}, Zr^{95}, and Ce^{144}. (C.H.)

8289 (AEC-tr-6266) RECENT PROGRESS IN THE DETERMINATION OF GASES IN METALS BY SPECTROGRAPHIC EMISSION. G. Rossi and J. Melamed (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). July 1961. Translation. 9p.

The method of Fassel has been used in order to analyze some nonmetals in the metals by using a chamber reduced in volume by cooling the walls. The limit of sensitivity can be lowered and the blank reduced to a negligible value. One linear curve for the determination of oxygen down to about 15μg independent of the character of the sample, has been obtained beginning with some mixtures of ZnO and graphite and tin oxide and graphite. A linear curve for the determination of hydrogen up to 15μg has been obtained from some samples of Zircaloy containing a known percentage of hydrogen. (auth)

8290 (EURAEC-818) GRAVIMETRIC DETERMINATION OF THE OXYGEN CONTENT OF URANIUM–PLUTONIUM MIXED OXIDES. Special Report No. 15. N. Mostin and G. Valentini (Brussels. Centre d'Études de l'Énergie Nucléaire and Societé Belge pour l'Industrie Nucléaire, Brussels). [1963]. Work Performed under United States–Euratom Joint Research and Development Program. Contract 027-60-7-RDB. 61p. (A translation of BN-6306-03)

A gravimetric method is described for the determination of the oxygen content in uranium–plutonium mixed oxides. Also described are: (1) A study, using a thermogravimetric balance, of the oxidation rates in air of uranium dioxide of different initial specific areas as well as the kinetics of reduction by hydrogen or carbon monoxide of U_3O_8 samples of various specific areas. From these measurements are deduced the time and the temperature needed to obtain stoichiometric oxides $UO_{2.667}$ and $UO_{2.000}$ or oxides of near-stoichiometric reproducible composition. In conclusion, standard working working conditions are established for the routine determination of interstitial oxygen in uranium dioxide; air is used for oxidation, while reduction is performed preferably under hydrogen. (2) The behavior of PuO_2 and Pu_2O_3 (or an intermediate composition) obtained from different salts heated in air, hydrogen, or carbon monoxide. The lowest temperature needed to obtain plutonium dioxide of approximately stoichiometric composition is 800°C for the heating conditions considered. (3) The determination of the interstitial oxygen content of plutonium-enriched uranium oxides. The experimental results show that, as in the case of uranium dioxide alone, the oxygen content can be determined with a reproducibility of ±0.004 stoichiometric units. (auth)

8291 (EURAEC-876) APPLICATION OF TRANSIENT ELECTROCHEMICAL METHODS TO THE CHEMICAL ANALYSIS OF PRODUCTS OF INTEREST IN NUCLEAR CHEMISTRY. Quarterly Report No. 12, July 1, 1963–September 30, 1963. (Brussels. Université). Work Performed under United States–Euratom Joint Research and Development Program. Contract 018-60-7-RDB. 18p. (A translation)

The study of the oxidation of carbonated quadrivalent uranium complexes by considering the influence exercised on the morphology and position of the polarographic waves by the nature of the support anion (slightly and highly tensio-active anions) was completed. The study of the behavior of hexavalent uranium complexes in a NaOH medium by examining the influence of the ionic force and the presence of CO_3^{-2} ions was continued. (N.W.R.)

8292 A RAPID, NONDESTRUCTIVE METHOD OF PRECISION OXYGEN ANALYSIS BY NEUTRON ACTIVATION. O. U. Anders and D. W. Briden (Dow Chemical Co., Midland, Mich.). Anal. Chem., 36: 287-92(Feb. 1964).

A new, highly automated method of elemental analysis for oxygen is described. The method represents an improvement over previous techniques and is capable of determining as little as 100 ppm of oxygen in all types of analytical samples. Only fluorine and fissionable materials interfere. Typical analyses of 7-ml samples containing on

the order of 1 to 100% oxygen can be measured with relative errors of 2%, requiring about 2 minutes of experimental time per sample. The technique of spinning samples with a tangential air-jet during measurement is described. The techniques of fast-neutron monitoring are compared and a method of measuring the effect of a variable flux on the production of a short-lived activation product is described. The dependence of the sample activation on the total macroscopic cross section and the vial diameter is demonstrated and a method is reported to minimize errors due to self-shielding. (auth)

8293 DETERMINATION OF THE STOICHIOMETRY OF SUBMILLIGRAM SAMPLES OF SODIUM–VANADIUM BRONZES BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS. Michael N. Soltys and George H. Morrison (Cornell Univ., Ithaca, N. Y.). Anal. Chem., 36: 293-6 (Feb. 1964).

An accurate nondestructive neutron activation method was developed for the determination of the stoichiometry of sodium–vanadium bronze single crystals. Using gamma spectrometry and appropriate irradiation and decay times, it was possible to measure the activities of Na^{24} and V^{52} without interference. Relative errors in multichannel pulse height analysis were investigated and reduced to better than 1.5% for vanadium and 2.5% for sodium. Single crystals of vanadium bronzes were analyzed by the method. (auth)

8294 WINDOWLESS SPECTROPHOTOMETRIC CELL FOR USE WITH CORROSIVE LIQUIDS. J. P. Young (Oak Ridge National Lab., Tenn.). Anal. Chem., 36: 390-2(Feb. 1964).

A new type of windowless spectrophotometric cell for use with molten fluoride salts and other corrosive liquids was developed. By means of this cell, called a captive liquid cell, light is transmitted through the side of a vertical column of liquid which is held in a metal cylindrical container of special design. No window material or mirrors are necessary to the operation of the cell. The path length of liquid samples held in this cell is independent of the weight, or volume, of sample initially placed in the cell but is postulated to be dependent on the surface tension and density of the liquid. Based on absorbance measurements in 0.250-inch (0.635-cm) OD cells, the path length of aqueous solutions is 0.68; the path length of the molten eutectic, LiF–NaF–KF, at 540°C is 0.77. The standard deviation of both these measurements is ±0.02 cm. The cell was used for spectrophotometric studies of molten fluoride salts. It should also be useful for spectrophotometric studies of other corrosive solutions and molten salts in their liquid states up to temperatures well over 1000°C. With the advent of high intensity monochromatic light sources, such as lasers, the cell seems ideally suitable for use in the field of Raman spectrometry. (auth)

8295 THE COLLECTION AND FLAME PHOTOMETRIC DETERMINATION OF CESIUM. Cyrus Feldman and T. C. Rains (Oak Ridge National Lab., Tenn.). Anal. Chem., 36: 405-9(Feb. 1964).

Traces of cesium can be concentrated from large volumes of water by batch adsorption on ammonium 12-molybdophosphate (AMP). Al^{3+} is used as a flocculant to facilitate collection of the AMP. The solids are dissolved in NaOH, Cs is extracted with a hexone-cyclohexane solution of sodium tetraphenyl boron, and the extract is burned in a flame photometer. The limit of detection is 0.005 μg Cs per ml of the solution burned. If the collection procedure is applied to an 8-liter water sample, this corresponds to a detection limit of 6×10^{-6} μg per ml of the water. With minor modifications the procedure can also be applied to sea water, tissue ash, and minerals. (auth)

8296 DETERMINATION OF THE DEUTERIUM CONTENT OF A SAMPLE OF DEUTERIUM OXIDE BY THREE METHODS. Maxwell Goldblatt and W. M. Jones (Los Alamos Scientific Lab., N. Mex.). Anal. Chem., 36: 431-2 (Feb. 1964). (LADC-5874)

Methods are described for the determination of deuterium content in D_2O by reduction-mass spectrometric, density analysis, and nuclear magnetic resonance. The accuracy of the iron decomposition-mass spectrometer method, when carried out with sufficient care, was confirmed by agreement with other methods. An uncertainty of 0.001% in the density of pure D_2O results in an uncertainty of 0.01% in the deuterium content. The NMR method for the measurement of small amounts of protium in deuterium oxide permits the deuterium content to be known to ±0.01%. (P.C.H.)

8297 DIRECT SPECTROPHOTOMETRIC DETERMINATION OF INDIUM IN TIN. Bruce A. Raby and Charles V. Banks (Ames Lab., Ames, Iowa). Anal Chim. Acta, 29: 532-8(1963). (IS-648)

Indium is separated from tin by an anion-exchange process in 0.5M hydrochloric acid solution. Subsequently, the indium is extracted into 1,2-dichlorobenzene as its complex with 5,7-dichloro-8-quinolinol. The complex forms and extracts quantitatively in the pH range 3–7. The yellow, organic phase is measured spectrophotometrically at 415 mμ; its absorbancy is directly proportional to the indium content of the aqueous phase up to a total of 1.5 mg of indium per 50 ml. This procedure quantitatively separates the two metals, allows one to determine the indium content of indium (<5%)–tin alloys with a relative error less than 0.7%, and considerably reduces color fading errors. (auth)

8298 SOME NEW UPPER LIMITS OF ISOTOPIC ABUNDANCE BY MASS SPECTROMETRY. F. D. Leipziger (Sperry Rand Research Center, Sudbury, Mass.). Appl. Spectry., 17: 158-60(1963).

Using a spark source mass spectrograph, a search was made for undiscovered naturally occurring isotopes of low abundance. None was found, although the spark source instrument permitted examination of elements that have not been analyzed in this context for many years. The ability of the instrument to ionize all elements and the ease with which the rarer isotopes may be seen allowed upper limits of <0.000001 atom % to be placed on some isotopes. Be, P, Mn, Co, As, Rh, Au, and Bi were confirmed as monoisotopic. (auth)

8299 SPECTROGRAPHIC DETERMINATION OF YTTRIUM OR LANTHANUM IN BERYLLIUM–COPPER ALLOYS. Keiji Kaneko and Shoichi Goseki (Electro-Technical Lab., Tokyo). Bunseki Kagaku, 12: 946-51(Oct. 1963). (In Japanese)

An oxide d-c excitation method using internal standards was applied successfully for the spectrographic determination of yttrium or lanthanum in beryllium–copper alloys. A series of standards covering 0.01 to 1.0% of each element with respect to yttrium or lanthanum is prepared in nitric acid solution. These solutions are evaporated to dryness in crucibles on a hot plate, and ignited in a muffle furnace at 800°C for 3 hours to be converted completely to black oxides. The samples are oxidized in exactly the same manner as the standards. Lanthanum is used as an internal standard for the determination of yttrium and yttrium is used for lanthanum. The shape of the electrodes

used is the same as that used in the carrier distillation method. The spectrographic conditions are as follows: amounts of the oxide, 100 mg; spectrograph, Shimazu Littrow type; excitation voltage, d-c 200 v; arc current, 12 amperes; slit width, 15μ; and duration of exposure, 40 sec. Variation coefficients of these determinations for the range of 0.01 to 1.0% for yttrium and lanthanum are 7.2 and 7.8%, respectively. (auth)

8300 SPECTROPHOTOMETRIC DETERMINATION OF YTTRIUM IN Fe–Cr–Al AND Ni–Cr ALLOYS. (ELECTRIC RESISTANCE MATERIALS). Hiroko Okada, Keiji Kaneko, and Shoichi Goseki. Denki Shikensho Iho, 27: 521-4(July 1963).

Spectrophotometric determination of yttrium in Fe–Cr–Al and Ni–Cr alloys by the use of methylthymol blue as a color reagent was studied. The sample of 0.1 to 1 g is dissolved with 1 to 1 hydrochloric acid, nitric acid, iron, nickel, and chromium in the alloy are separated by mercury cathode electrolysis. An aliquot of the solution is transferred into a 100 ml beaker, and definite amounts of acethylacetone and methylthymol blue solutions are added. The mixture is adjusted to pH 6.4 ± 0.05 by ammonia water and hexamine solution, and is poured into a 25 ml volumetric flask, which is then filled with pure water. The absorbance is measured at 610 mμ after twenty minutes. The coefficients of variation are 4.8% for the yttrium levels of 0.1 to 1%. (auth)

8301 SCINTILLATION COUNTING OF AQUEOUS SOLUTIONS. Gerald Moss (Albany Medical Coll.). J. Nucl. Med., 5: 69-71(Jan. 1964).

A simple unit is described that will allow efficient scintillation counting of aqueous solutions without destruction of the sample. (C.H.)

8302 RADIOACTIVATION ANALYSIS. Kenji Motozima and Shoji Bando (Japan Atomic Energy Research Inst., Tokyo). Kagaku Kogyo, 14: 771-8(Aug. 1963). (In Japanese)

The general principle of radioactivation analysis by thermal neutrons is followed by an explanation of the nature of thermal neutrons, the cross section, neutron flux, saturation factor, and measurement of radioactivity. The distribution of the neutron flux of JRR (Japan Research Reactor)–1 and –2 is shown, and the research reactors in Japan are tabulated. The distinctive features of radioactivation analysis are high sensitivity, specific reaction, and simple chemical separation. Its defects include indispensability of neutron source equipment, radiation damage, a possibility of side reactions and an error due to self-shielding. As examples, analytical results on reactor materials such as Zr, Be, and graphite, and on high-purity metals such as Ge, Si, and Ti are shown, and the radioactivation analysis carried out by JRR–1 is tabulated. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8303 SOME PROBLEMS OF SURFACE MEASUREMENTS FOR DETERMINING THE HUMIDITY OF SOLIDS BY MEANS OF NEUTRONS. R. Schroller and H. Stiede (Forschungsinstitut Manfred von Ardenne, Dresden). Kernenergie, 6: 643-9(Nov. 1963). (In German)

Investigations on the principles of retarding of fast neutrons by water to develop a practical measuring method for nondestructive moisture determination in building parts and walls of buildings among other objects are described. Two different measurement arrangements were tested; for one the source of fast neutrons and the detector for thermal neutrons were on the same side, in the other on opposite sides, of the measured object. The effects of moisture distribution and measuring geometry on the density of thermal neutrons at the detector were considered and the insertion possibilities of both methods were judged. For both methods the attainable ranges with regard to material thickness and moisture content are given and the influence of moisture distribution of the measurement results is discussed. (tr-auth)

8304 BROMINE DETERMINATION IN ZINC SULPHATE BY ACTIVATION ANALYSIS. H. Koch and K.-D. Grossmann (Institut fur Angewandte Radioaktivitat, Leipzig). Kernenergie, 6: 651-3(Nov. 1963). (In German)

A quantitative bromine determination in zinc sulfate is described. By means of an anion exchanger the radioactive cations were first separated. On a silver-loaded KPS-200 column, the separation of sulfate, phosphate, and bromide was accomplished. Br^{82} was measured as AgBr. (tr-auth)

8305 INDIRECT POLAROGRAPHIC DETERMINATION OF ZIRCONIUM. Chih-te Hu, Shu Wang, and Shu-yun Chang. Kexue Tongbao, No. 2, 34-5(1962).

An indirect method is proposed for determination of Zr in quartz, consisting in precipitating Zr with m-nitrobenzoic acid (I) at pH 0.5 to 1.2, dissolving the precipitate in $HClO_4$, and subsequent polarography of I in the resultant solution (NO_2-groups are reduced) in the presence of citric or tartaric acid, added to prevent hydrolysis of Zr. The sample is carefully fused in a Pt crucible with borax, at 700 to 900°C for 10 to 20 minutes. On cooling, anhydrous Na_2CO_3 is added and the fusion is repeated. The melt is leached by boiling with water, cooled, and filtered. The residue is washed 5 to 6 times with 2% solution NaCl, dissolved in hot 5N HCl, pH is adjusted to 0.5 to 1.2 with ammonia, and Zr^{4+} is precipitated at about 80° with saturated solution of I. The precipitate is filtered off, washed to remove all excess of I, and dissolved in a hot mixture (1:2) of concentrated $HClO_4$ and 10% solution of Na citrate (or of 20% solution of tartaric acid). The resulting solution is neutralized to Methyl Red with ammonia, 5 to 10 ml saturated solution K-biphthalate and 6 to 10 drops 1% solution of alphanaphthol are added, and the solution is then diluted to 100 ml, N_2 is passed into it, and polarography is carried out from –0.3 to –0.8 v (with respect to a saturated calomel electrode). Height of the wave is directly proportional to Zr concentration in the interval of 0.3 to 3.5 mg Zr per 100 ml solution. A determination of 2.5 mg Zr is not interfered with by 250-fold amounts of U, 200-fold amounts of Ce^{3+}, 30-fold amounts of Fe, and 20-fold amounts of Th, which permits Zr to be determined in U, Ce, or U–Ce–Th alloys. The Cl^-, NO_3^-, and ClO_4^- anions do not interfere. The ions SO_4^{2-} and PO_4^{3-} interfere due to the formation with Zr of complex compounds or precipitates. The relative error of the method is 3%. The results obtained coincide with data of gravimetric and photometric (when Na alizarin sulfonate is used) determinations of Zr, but the proposed method is simpler and more rapid. (OTS)

8306 ANALYTICAL CHEMISTRY. VOLUME 3. Carl E. Crouthamel, ed. Progress in Nuclear Energy. Series IX. Progr. Nucl. Energy, Ser. IX, 3: 163-265(1963). New York, Pergamon Press, 1963. $3.50.

Three articles are included; each is separately abstracted in NSA. (P.C.H.)

For abstracts of individual papers see: 8307, 8308, and 8309.

8307 CHEMICAL MONITORING OF HEAVY WATER MODERATED RESEARCH REACTORS. L. E. Smythe (Australian Atomic Energy Commission Research Establish-

ment, Sydney). Progr. Nucl. Energy, Ser. IX, 3: 163-89 (1963).

A review is presented on the chemical monitoring of heavy water reactors. Commissioning tests, chemical problems, and staff requirements and facilities are discussed. 122 references are included. (P.C.H.)

8308 RECENT ADVANCES IN THE ANALYTICAL CHEMISTRY OF BERYLLIUM. L. E. Smythe and T. M. Florence (Australian Atomic Energy Commission Research Establishment, Sydney). Progr. Nucl. Energy, Ser. IX, 3: 191-235(1963).

A review is presented on the preparation of Be standards and methods for the determination and separation of Be. The methods considered are: gravimetric, volumetric, spectrophotometric, fluorometric, polarographic, radiometric and radiochemical, and spectrometric. 294 references are included. (P.C.H.)

8309 A LARGE-SCALE FACILITY FOR CHEMICAL RESEARCH WITH INTENSELY RADIOACTIVE MATERIALS. Donald C. Stewart (Argonne National Lab., Ill.). Progr. Nucl. Energy, Ser. IX, 3: 237-65(1963).

Description is given of the new hot laboratory in the Chemistry Division at Argonne National Laboratory. The structure is exceptionally large and contains areas for work with activity ranging from the trace to million curie levels. The cell complex is integrated with a variety of support areas, including a number of laboratories equipped to handle multicurie quantities of alpha emitters, while the cells themselves were designed with shielding against neutrons emitted by spontaneously fissioning nuclides as well as against the more usual γ-β-radiations. The interior of the entire complex is remotely accessible by means of a materials transport system unique in current hot laboratory design. The interiors of the heavy duty cells can be viewed from three sides in all cases, and are designed for the use of in-cell containment boxes for contamination control. Dimensions and design criteria are tabulated. (P.C.H.)

8310 CHEMISORPTION DETECTOR FOR OXYGEN. Donald J. Collins and Stuart A. Hoenig (Univ. of Arizona, Tucson). Rev. Sci. Instr., 35: 15-16(Jan. 1964).

The device depends upon the increase in work function of a tungsten filament when chemisorption of oxygen occurs. The device is sufficiently sensitive to detect oxygen at pressures of 10^{-11} torr and is insensitive to nitrogen for ratios as high as $N_2/O_2 \approx 10/1$. (auth)

8311 THE MEASUREMENT OF THE ABUNDANCE RATIO OF LITHIUM ISOTOPES USING ATLAS CH 4 MASS-SPECTROMETER. Yoshihiro Mori (Tokyo Inst. of Tech.) and Terunosuke Nomura. Shitsuryo Bunseki, 10: 120-4 (Oct. 1962). (In Japanese)

One drop of 200 mg/ml LiI solution is deposited in the ionization case. Under conditions such that the max peaks of Li^7 and Li^6 can be obtained, the peaks due to these isotopes are recorded repeatedly. More than 20 measured values of the abundance ratio in the region around the point on which the ionization current reaches a max are determined, and their average value is assumed as the (true) abundance ratio of the sample used. In order to investigate the difference of anions in the sample, LiCl, LiI, $LiNO_3$, and Li_2SO_4 were used, and LiI was found to be most suitable. The measured value of the abundance ratio varies according to the type of the ionization case and conditions of the determination. The effect of ionization current is large, and, generally, the measured value of the abundance ratio increases with increasing heating current. The amount of sample, the spotting point, and the measuring time must be constant. In the measurement of relative value, the error is checked within ±0.1%. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8312 BASIC STUDY ON ACTIVATION ANALYSIS. III. METHOD OF THE CHOICE OF "COOLING TIME" TO REDUCE INTERFERING ACTIVITY IN NEUTRON ACTIVATION ANALYSIS. Fumio Aoki and Minoru Okada. Tokyo Kogyo Shikensho Hokoku, 58: 479-85(Nov. 1963). (In Japanese)

To choose the best cooling time to minimize interfering γ rays in activation analysis, the cooling time was examined theoretically. When the half-life of interfering activity cannot be foreseen, there is an optimum cooling time which depends on the irradiation time and on the half-life of product nuclide of interest. When an interfering nuclide is foreseen, the effect of the irradiation time and that of cooling time on signal-to-noise ratio can be estimated graphically, where a γ ray emitted from a product nuclide of interest is likened to a "signal," and the interfering γ ray to a noise. The graphical method consists of moving the curves of a certain shape on a chart including many spots with the names of naturally occurring nuclides. Since the γ ray abundances for all the nuclides formed were necessary to make the chart, and since many of them were unknown, attempts were made to estimate the unknowns from the related data. (auth)

8313 BASIC STUDY ON ACTIVATION ANALYSIS. IV. OBSERVATION OF THE EXTENT OF THE FORMATION OF SHORT-LIVED, γ ACTIVE NUCLIDES BY NEUTRON IRRADIATION. Minoru Okada. Tokyo Kogyo Shikensho Hokoku, 58: 486-8(Nov. 1963). (In Japanese)

Samples of some elements were irradiated with pile neutrons, the cadmium ratio of which was 3. The emission rate of the abundant γ ray of each nuclide formed was measured by use of a 256-channel γ scintillation spectrometer. The emission rate was then normalized for the following conditions: the weight of element used = 1 μg, neutron flux density = 10^{11} n·cm^{-2}·sec^{-1}, irradiation time = T, where T is the half-life of a nuclide formed. The normalized emission rate is defined as {(counts collected during a counting time lying from T sec after irradiation till 2 T sec after irradiation)/, (counting time of T)}/(photo-peak efficiency). Thirty-six nuclides with half-lives ranging from 1 sec to 5 min were observed. The coefficient of variation of observations was found for a few nuclides to be 50 to 100%. (auth)

8314 STUDY ON RAPID ANALYSIS BY RADIOACTIVATION. VI. DETERMINATION OF YTTERBIUM IN AQUEOUS SOLUTIONS AND IN THULIUM OXIDE. Minoru Okada. Tokyo Kogyo Shikensho Hokoku, 58: 489-91(Nov. 1963). (In Japanese)

A neutron activation analysis method was devised for the rapid determination of ytterbium in aqueous solutions and in thulium oxide powder. Sample and standard were irradiated separately with neutrons at a flux of 3×10^{11} neutrons per cm^2/sec for 6 sec, and then the rate of decay of produced γ ray activities of 0.104-Mev with the half life of 6 sec was determined by use of a sodium iodide crystal attached to a 256-channel pulse height analyzer. A calibration curve for 0.01 ~1 mg ytterbium was prepared. By this method 0.064% ytterbium in aqueous solution was determined within 5% errors. (auth)

8315 A NEW SERIES OF ELECTROGENERATED REAGENTS AND A STUDY OF CERTAIN ELECTROMETRIC METHODS FOR THE DETERMINATION OF FLUORIDE ION. Yao-sin Su. Thesis, Pittsburgh, Univ. of Pittsburgh, 1962. 145p.

The coulometric generation of 11 metal ions directly from the corresponding metal anodes was studied, together with the application of these ions to coulometric titrations and the application of these ions to coulometric titrations and the suitability of this and other electrometric methods to the determination of fluoride ion. Of the metals selected for investigation, Bi, Zr, Hf, Ni, Pb, and In were studied extensively. The conditions for quantitative or reproducible generation were established for Bi(III), Zr(IV), Hf(IV), Ni(II), and In(III). These ions now constitute a new series of electrogenerated reagents. The usefulness of these electrogenerated reagents has been demonstrated by their successful application to coulometric titrations. A procedure for the standardization of ethylenediaminetetraacetic acid (EDTA) solution with Bi(III) ion was developed. EDTA solutions having concentrations from 10^{-5} to 4×10^{-4} M were determined with errors of less than 0.5%. Electrogenerated Zr(IV) ion was studied for its applicability to a determination of fluoride ion. The end point of this coulometric titration was located amperometrically using Fe(III) as a polarographic indicator. The lowest amount of fluoride ion determined was about 5×10^{-5} moles (1 mg). The possibility of standardizing a cyanide solution with electrogenerated Ni(II) ion was also considered, and the results indicated some interesting aspects concerning Ni-cyanide complexes. The use of bismuth nitrate and bismuth oxyperchlorate as precipitants for fluoride ion was studied both by amperometry and conductometry. A preliminary investigation was made of the use of Be(II) as a reagent in the determination of fluoride ion conductometrically. (M.P.G.)

8316 CONVERSION OF OXYGEN INTO CO_2 FOR THE PURPOSE OF THE ISOTOPIC DETERMINATION OF O. H. Hering, H. Le Bail, M. Majzoub, J. Sutton, and A. Vanderchmitt (Centre d'Etudes Nucleaires, Saclay, France). Vienna, International Atomic Energy Agency, 1963, Preprint SM-50/2, 12p. (CONF-269-13). (In French)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

The isotopic determination of O^{18}/O^{16} can be very conveniently carried out on CO_2. In transforming oxygen into CO_2, it is necessary to avoid any contamination of the oxygen by external sources and to obtain a reasonably complete transformation so as to avoid any isotopic effect between CO and CO_2. It is shown that the degassing of graphite under vacuum at a temperature of 950°C removes from it the chemically absorbed oxygen in sufficient measure to prevent any substantial contamination of the oxygen that is subsequently converted by the combustion of the graphite. An apparatus capable of transforming into CO_2 97.5% of the oxygen introduced into it is described. (auth)

8317 A NEUTRON ACTIVATION METHOD FOR SOIL REMOVAL MEASUREMENT. Daniel A. Netzel, Charles W. Stanley, and Donald W. Rathburn (Midwest Research Inst., Kansas City, Mo.). 19p. (CONF-371-1)

From American Oil Chemists Society 37th Annual Fall Meeting, Minneapolis, Sept. 30-Oct. 2, 1963.

A neutron activation method was developed for determining the absolute soil content on test cloths both before and after cleaning to evaluate the detergent effectiveness of a surfactant. Kaolinite-clay-soiled cloth was used in the studies. Neutron irradiation of the clay resulted in the activation of aluminum atoms in the lattice structure of the clay. A pneumatic tube assembly built into a reactor allowed the cloth samples to be exposed to the high neutron density at the reactor core. Planchets of high-density polyethylene were used to hold the soiled cloth. Activities of the soiled cloth samples were determined using gamma scintillation counters. After washing the cloth samples, activities were measured again and the values compared to compute the amount of soil remaining on the washed cloth. (M.C.G.)

8318 METHOD AND ARRANGEMENT FOR THE CONTINUOUS DETECTION OF SMALL TRITIUM CONCENTRATIONS IN THE AIR. Emil Kowalsky (to Landis and Gyr AG). German Patent 1,153,550. Aug. 29, 1963. Priority date Mar. 10, 1961, Switzerland.

The arrangement described comprises two similar ionization chambers with air of natural activity flowing through one (compensation chamber). In order to balance out the signal caused by the background radiation, these chambers are connected electrically so that their outputs subtract. The air for the compensation chamber is obtained by passing part of the air wherein the presence of tritium is to be detected through a device in which the tritium is removed. (Gmelin Inst.)

8319 APPARATUS FOR THE MEASUREMENT OF THE WATER OR HYDROGEN CONTENT OF A MATERIAL INDEPENDENT OF ITS LAYER THICKNESS WITH THE HELP OF NEUTRONS. Rudiger Tornau (to Frieseke and Hoepfner GmbH). German Patent 1,155,924. Oct. 17, 1963. Filed May 5, 1961.

The apparatus described comprises a neutron source, neutron detectors, and neutron reflectors. The neutron reflectors are located opposite the source and the detectors so that the material to be assayed is moved between the reflector and the other parts of the apparatus. This apparatus measures water content, e.g., of material moved on a conveyor belt above a given layer thickness independent of the thickness. (Gmelin Inst.)

8320 CHROMATOGRAPHY FOR MEASURING TRACES OF IMPURITIES IN A GAS. Vincent Willis (to Imperial Chemical Industries Ltd.). U. S. Patent 3,117,225. Jan. 7, 1964. Priority date Apr. 1, 1959, Great Britain.

A process of gas analysis is described in which the sample to be analyzed is mixed with a noble gas as carrier and passed through an ionization chamber where the gas is ionized by radiation from a selected radioisotope source. The presence of trace impurities in the carrier gas gives rise to fluctuations in the steady level of ionization produced when pure carrier gas is passed through the device. The extent of these fluctuations are dependent on the nature and concentration of the impurities. The sensitivity of the method is improved by adding to the gas stream a known, relatively small, substantially constant amount of a substance in the gaseous phase, which has an ionization potential substantially equal to the excitation potential of metastable atoms of the noble gas. (M.C.G.)

Inorganic and Physical Chemistry

8321 (CONF-175-3) EQUILIBRIUM STUDIES OF URANYL COMPLEXES. II. INTERACTION OF URANYL ION WITH CITRIC ACID. K. S. Rajan and A. E. Martell (Illinois Inst. of Tech., Chicago). [1964]. Contract AT(11-1)-1020. 28p.

From American Chemical Society 142nd National Meeting, Atlantic City, Sept. 1962.

A potentiometric study of complex formation between citric acid (H_3L) and the uranyl ion at 25° and ionic strengths of 0.1 and 1.0 (KNO_3) is reported. From the concentration dependence of the formation constant, it is con-

cluded that polynuclear complexes are formed in which bridging between metal ions occurs through carboxylate and hydroxyl groups of the ligand. The values of the logarithms of the formation constant of the metal chelate $[UO_2L^-]/[UO_2^{2+}]\ [L^{3-}]$ and of the dimerization constant $[(UO_2)_2L_2^-]/UO_2L^-]^2$ are found to be 7.40 and 4.07, respectively. Infrared absorption measurements of protonated and dissociated carboxyl groups in aqueous uranyl citrate system indicates the presence of both carboxylate and hydroxide bridging in the polynuclear complex. On the basis of the "core plus links" treatment of polynuclear complexes, the polymeric species in solution in the buffer region between 3 and $4\frac{2}{3}$ moles of base per mole of metal complex appears to be predominantly $(UO_2)_2L_2((OH)_3(UO_2)_2L_2)_2^{4-}$. (auth)

8322 (IS-598) RELAXATION PHENOMENA IN THE ELECTRICAL DOUBLE-LAYER. Daniel Harrison Grantham and Robert S. Hansen (Ames Lab., Ames, Iowa). Nov. 1962. Contract W-7405-eng-82. 101p.

After assembling an instrument capable of high sensitivity, a substitution technique was applied to investigate the frequency dependence of the double layer capacitance at the interface between mercury and aqueous electrolytic solutions for several polarizations of the mercury and for three temperatures. Several electrode designs for forming the interface were tested for reproducibility of the measurements with particular emphasis placed on those designs permitting a flat interface to be formed. It was shown that the frequency dependence of both the capacitance and resistance was due to a distributed capacity effect analogous to that which is found in the transmission lines of communications engineering. An annulus was postulated to exist between the supporting glass sheath and the gold tube, at the end of which the flat mercury interface was formed. A reasonable value for the separation of gold and glass was assumed and proved to be sufficient to account for the observed trend and order of magnitude of the frequency dependence of the capacitance and resistance. A complete frequency independence of the capacity and resistance was demonstrated for an interface between a mercury droplet and electrolytic solution. The droplet was extruded from a capillary of about 65 microns internal diameter having a hydrophobic inner wall. Application of Desicote to the inner wall was sufficient to prevent solution penetration between the glass of the capillary and the mercury thread and thus remove the source of the distributed capacity effect. This effect had not been eliminated by others using the growing mercury drop who reported small capacity variations with frequency, and large, but not reproducible resistance variations variously attributed to shielding of the droplet and to a relaxation process in the double layer. (auth)

8323 (IS-742) THE CATION EFFECT ON ACID-BASE REACTIONS IN FUSED ALKALI NITRATES. James Alfred Luthy and F. R. Duke (Ames Lab., Ames, Iowa). Aug. 1963. Contract W-7405-eng-82. 45p.

An oxygen electrode was used in conjunction with a glass-silver nitrate-silver electrode to determine the effect of a change of the cation ratio on the decomposition reaction of nitrate ion by pyrosulfate ion. The reaction was carried out in various mixtures of sodium and potassium nitrate and in pure sodium nitrate. The reaction was found to be more complicated at 300°C than has been reported at lower temperatures. The reaction could not be carried out in mixtures containing more than 60 mole per cent potassium nitrate or in pure potassium nitrate because of some change in the electrode system. It was found that the log K varied linearly with change in mole per cent potassium nitrate. The equilibrium constant was found to increase with an increase in mole per cent of potassium nitrate. It was also found that the rate constant decreased with an increase in mole per cent potassium nitrate. There was also a linear relationship between log k and the mole per cent potassium nitrate. An explanation was postulated for the observed data. Because the potassium ion is less polarizing, a speculated association between the nitryl ion and the nitrate ion is stabilized. This stabilization slows the reaction $NO_3^- + NO_2^+$ = Products and forces the equilibrium $S_2O_7^{2-} + NO_3^- = 2SO_4^{2-} + NO_2^+$ further to the right, thereby increasing the equilibrium constant. The results of this study were the reaction of the electrode system in mixtures of sodium and potassium nitrate which contain more than 60 mole per cent potassium nitrate and the dependence of the specific rate constants and equilibrium constants on the cation ratio. (auth)

8324 (KAPL-M-MSB-1) CONSTRUCTION OF POTENTIAL-pH DIAGRAMS FOR THE NICKEL–WATER, CHROMIUM–WATER, AND IRON–WATER SYSTEMS AT 25°C. M. S. Bushey—C. F. Cheng, ed. (Knolls Atomic Power Lab., Schenectady, N. Y.). Sept. 20, 1963. Contract W-31-109-eng-52. 18p.

The potential–pH diagram for iron–water and chromium–water systems at 25°C are redrawn from published literature data to show a time dependency. The regions of passivation by (a) fresh corrosion products and (b) well-aged corrosion products are outlined. For the nickel–water system, the time dependency is omitted due to insufficient data, but the minimum solubility for fresh corrosion product ($Ni(OH)_2$) is shown. (auth)

8325 (LA-2992) PREPARATION OF AMERICIUM METAL. K. W. R. Johnson and J. A. Leary (Los Alamos Scientific Lab., N. Mex.). Oct. 31, 1963. Contract W-7405-eng-36. 16p.

The first preparation of Am metal on a macroscopic scale is reported. A total of 22.5 g of Am metal was prepared in three reductions by reaction of AmO_2 with La in vacuo. The products from two of the three reductions were cast into ingots, the largest ingot weighing 10.5 g. Average over-all yield was 74%. (auth)

8326 (LAMS-2994) LOSS OF ZIRCONIUM AND URANIUM FROM FLUIDIZED BEDS OF ZrC AND UC–ZrC PARTICLES AT HIGH TEMPERATURES. A. C. Juveland, H. P. Deinken, and J. E. Dougherty (Los Alamos Scientific Lab., N. Mex.). Aug. 1, 1963. Contract W-7405-eng-36. 48p.

The mass loss rates of uranium and zirconium from beds of UC–ZrC particles fluidized by helium or hydrogen were measured in the temperature range from 2300 to 2700°C. The particle sizes, bed depths, and fluidizing gas flow rate were varied over a wide range, and it appears that the exit gas was in chemical equilibrium with the particles. The loss rate of U seemed to be largely controlled by diffusion in the solid particles. The loss rates were considerably larger when hydrogen rather than helium fluidizing gas was used. Some chemical reactions involving the formation of C_2H_2 are suggested which explain most of the Zr losses when H_2 was used. Indications are that reactions involving CH_4 did not have time to occur during the transit time of a volume element of the gas stream. (auth)

8327 (NBL-204(p.5-6)) DISSOLUTION OF ELEMENTAL BORON. A. R. Eberle and M. W. Lerner (New Brunswick Lab., AEC, N. J.).

Two methods for the dissolution of boron are presented.

One involves incomplete dissolution in nitric acid followed by addition of sodium carbonate, evaporation to dryness, and fusion of the entire residue. The other is a potassium persulfate fusion technique. (auth)

8328 (NBL-204(p.41-5)) STABILITY TESTING OF PLUTONIUM SULFATE TETRAHYDRATE AND DICESIUM PLUTONIUM HEXACHLORIDE. C. E. Pietri (New Brunswick Lab., AEC, N. J.).

A study of the weight stability with time of plutonium sulfate tetrahydrate and dicesium plutonium hexachloride, proposed primary analytical standards for plutonium, was continued. A statistical evaluation of data accumulated over 13- to 33-month test periods disclosed significant weight loss trends for both compounds. The rate of loss per year ranged from 0.01 to 0.13%. (auth)

8329 (NBL-204(p.47-57)) MULTIGRAM PREPARATION OF $Pu(SO_4)_2 \cdot 4H_2O$ AND $Pu(SO_4)_2$ FOR EVALUATION AS ANALYTICAL STANDARDS. C. E. Pietri and A. W. Wenzel (New Brunswick Lab., AEC, N. J.).

Homogeneous lots of approximately 400 grams each of plutonium sulfate tetrahydrate and anhydrous plutonium sulfate were prepared as candidate materials for the evaluation of primary analytical standards for plutonium. The plutonium assay of the compounds indicated that these materials were stoichiometric in composition within experimental limits. The impurity assay revealed that both compounds were of relatively high purity, although prepared from plutonium metal of about 99.8% purity. An overall yield of 99.8% for the tetrahydrate and 99.7% for the anhydrous salt was obtained. The processing of multigram amounts of material and some of the problems encountered in the preparation are described. (auth)

8330 (PWAC-426) THE ENTHALPY AND HEAT CAPACITY OF URANIUM MONOCARBIDE TO 1200C. L. C. Harrington and G. H. Rowe (Pratt and Whitney Aircraft Div., United Aircraft Corp. Connecticut Aircraft Nuclear Engine Lab., Middletown). Jan. 8, 1964. Contract AT (30-1)-2789. 14p.

The enthalpy of uranium monocarbide was measured in the range 0 to 1204°C using an ice calorimeter. Determinations were made from five elevated temperatures to 0°C. The accuracy of these measurements is estimated to be ±4%. The heat capacity was calculated from these data. These measured values for enthalpy and calculated values for heat capacity are compared with values found in the literature. The measurements of the enthalpy of platinum–20% rhodium from 0 to 1538°C are also presented. These measurements were needed to correct the observations for the heat content of the platinum–20% rhodium capsule in which the specimen was sealed while heat content measurements were being made. (auth)

8331 (RFP-357) SUMMARY OF AVAILABLE INFORMATION ON PLUTONIUM NITRATE SOLUTION INSTABILITY. F. J. Miner (Dow Chemical Co. Rocky Flats Plant, Denver). Jan. 23, 1964. Contract AT(29-1)-1106. 27p.

The shipper-receiver differences experienced during two periods of time when production batches of feed nitrate were sent from Hanford to Rocky Flats are summarized. A comparable summary was also made for shipments from Oak Ridge to Rocky Flats. The Analytical Laboratory Sample Exchange Program for plutonium nitrate solutions as well as metallic plutonium samples exchanged at the same time is also summarized. A literature review was made of the formation and precipitation of plutonium (IV) polymer. Suggestions for avoiding polymer are given. The possibility of the formation of insoluble compounds of plutonium (IV) with inorganic anions or organic compounds resulting from the degradation of anion exchange resins is also discussed. (auth)

8332 (TID-19990(Paper 5)) A STUDY OF THE PHOSPHIDATION OF ZIRCONIUM. F. F. H. Freund and K. A. Gingerich (Pennsylvania State Univ., University Park). 19p.

The direct interaction between phosphorus vapor at 1 atm and Zr metal was studied over the temperature range from 500 to 1100°C. At first, the reaction layer being less than 1 μ thick, only subphosphide of the probable composition Zr_3P was formed. Further phosphidation yielded the hexagonal monophosphide ZrP, besides traces of subphosphide. The rate of reaction was small between 500 and 700°C and increased rapidly above 700°C. At 1000°C it is a linear function of time for reaction layers less than 0.05 mm thick. This indicates that possibly due to cracks in the brittle phosphide layer, the phosphidation takes place always at a fresh metal surface. A non-identified black phase containing Zr and possibly phosphorus was vapor-deposited on the walls of the reaction tubes. (auth)

8333 (TID-19990(Paper 8)) NOTES ON MASS SPECTROMETRIC STUDY OF UP–UO_2 SYSTEM. K. A. Gingerich, P. K. Lee (Pennsylvania State Univ., University Park); and J. Efimenko (National Bureau of Standards, Washington, D. C.). 10p.

Studies were made on the UP–UO_2 system to investigate the function of oxygen contaminant in UP on vaporization. The gaseous species observed were mainly P^+, P_2^+, U^+, UO^+, and UO_2^+. The oxygen content in UP–UO_2 was calculated to be 6.673% by weight. This corresponds to a mole ratio of UP to UO_2 of 0.44 to 0.56, respectively. The relative ion intensity ratio of U : UO : UO_2 was, at the average temperature of 2100°K, found to be 1 : 9.49 : 3.31. From the results it was concluded that the function of oxygen impurities present in UP sample is reacted with UP on vaporization according to the reaction $UP_{(s)} + UO_{2(s)} = 2UO_{(g)} + (1/x)P_{x(g)}$, where x = 1 or 2, and in a mixture of UP and UO_2 when the mole ratio of UP and UO_2 is in equimolar, or UO_2 is in higher proportion, the previous reaction and $UO_{2(s)} = UO_{2(g)}$ would occur simultaneously and independently during the vaporization process. (P.C.H.)

8334 (TID-19997) SPECIFIC CONDUCTANCE AND DENSITY MEASUREMENTS IN FUSED ALKALI METAL NITRATE SYSTEMS. PART I. SOLVENT SYSTEMS AND BINARY SOLUTIONS. Plutarchos C. Papaioannou and George W. Harrington (Temple Univ., Philadelphia). [1963]. Contract [AT(30-1)-2082]. 38p.

The specific conductance and density of $(Li,K)NO_3$ eutectic, $(Na,K)NO_3$ eutectic, and pure KNO_3 in the molten state were studied as functions of temperature. From the equivalent conductance data, energies of activation, free volumes, and entropies of activation were calculated. The effects on specific conductance and density caused by small additions of alkali metal halides, transition metal halides, and transition metal nitrates to these systems were investigated. Finally, partial equivalent conductances for the binary systems considered were obtained. (auth)

8335 (TID-19998) SPECIFIC CONDUCTANCE AND DENSITY MEASUREMENTS IN FUSED ALKALI METAL NITRATE SYSTEMS. PART II. CONDUCTOMETRIC TITRATIONS. Plutoarchos C. Papaioannou and George W. Harrington (Temple Univ., Philadelphia). [1963]. Contract AT(30-1)-2082. 27p.

Conductometric titrations using alkali halides as titrating agents, were performed on solutions of Co(II) and Ni(II) in $LiNO_3-KNO_3$ and $NaNO_3-KNO_3$ eutectics, respectively. The solutions were quite dilute but nevertheless conduction minima were obtained for the expected ratios of transition metal ion: halide ion. In addition a precipitate was obtained from solutions of $CoCl_2$ in $LiNO_3-KNO_3$ in the presence of excess chloride. The precipitate analyzed to $Li_4CoCl_2(NO_3)_4$. (auth)

8336 (UCRL-10857) THE VAPOR PRESSURE OF INDIUM SULFIDES AS FUNCTIONS OF COMPOSITION AND TEMPERATURE (thesis). Alan R. Miller (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). Oct. 21, 1963. Contract W-7405-eng-48. 42p.

A dynamic method for obtaining pressure-vs-composition data in two-component systems is demonstrated for part of the indium–sulfur system. The composition range of the phase designated as indium sesquisulfide was investigated by means of x-ray diffraction and mass spectrometry in the temperature interval 600 to 900°C. The results show that the phase has a significantly wide solubility range and that the reported In_3S_4 phase does not exist. The major vapor species above indium sesquisulfide in this temperature interval are In_2S and S_2. The activity of sulfur in the condensed phase was deliberately changed in a series of experiments. Indium or sulfur was fused with the indium sesquisulfide to form various compositions, which when heated in the mass spectrometer returned to the sesquisulfide composition. The major vapor species, observed in a mass spectrometer as the condensed-phase composition was changing, were used to calculate the free energy of formation as a function of composition and temperature for indium sesquisulfide and a phase of approximate composition In_3S_5. The heat of formation of $In_2S(g)$ at 298°K was calculated to be 14.6 ± 5 kcal/mole. The free-surface sublimation rate was about 0.01 times the equilibrium rate at 1000°K. (auth)

8337 (UCRL-Trans-1005(L)) ON THE ROLE OF PHYSICAL-CHEMICAL PROCESSES DURING CALORIMETRIC MEASUREMENTS OF RADIOACTIVE SUBSTANCES. N. S. Shimanskaya. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore), from Tr. Radievogo Inst., Akad. Nauk SSSR, 9: 131-3(1959). 6p.

The possible effects of side physical or chemical reactions in the calorimetry of radioactive substances are discussed briefly. Preliminary results are presented of control tests of these auxiliary thermal effects in strong Po^{210} preparations; these effects were found to be small, approximately 1.5 to 2%, and insignificant after 2 to 3 days. (D.L.C.)

8338 THERMODYNAMIC PROPERTIES OF RARE EARTH COMPLEXES. I. STABILITY CONSTANTS FOR THE RARE EARTH DIGLYCOLATE COMPLEXES. Ingmar Grenthe and Inga Tobiasson (Univ. of Lund, Sweden). Acta Chem. Scand., 17: 2101-12(1963).

The stability constants for the diglycolate complexes of the tervalent rare earths were determined in an aqueous perchlorate medium of the ionic strength I = 1.00 M and at a temperature of 20.0°C. Corresponding values of $\bar{n}$ and [A] were determined by a potentiometric standard method by the determination of the concentration hydrogen-ion by means of the quinhydrone electrode. From the $\bar{n}$-[A] data stability constants for three mononuclear complexes were determined. No evidence of the formation of polynuclear or acid complexes was found in the concentration range used. (auth)

8339 CARRIER TECHNIQUE FOR QUANTITATIVE ELECTRODEPOSITION OF ACTINIDES. M. Y. Donnan and E. K. Dukes (E. I. du Pont de Nemours & Co., Aiken, S. C.). Anal. Chem., 36: 392-4(Feb. 1964). (TID-19034)

A carrier method was developed for the rapid quantitative electrodeposition of actinides from aqueous solutions onto alpha counting plates. Incremental addition of natural uranium as the carrier for actinides of high specific activity was necessary for quantitative electrodeposition. A recovery of 99.8% was obtained in detailed study with plutonium solutions, and in scouting experiments the carrier technique markedly improved the electrodeposition yields of neptunium, americium, and curium. The excellent quality of the deposits permitted alpha counting with a relative standard deviation of ±0.2%. (auth)

8340 SOLUBILITY OF URANIUM TETRAFLUORIDE IN AQUEOUS SOLUTIONS OF ACIDS. Yu. A. Luk'yanychev and N. S. Nikolaev. At. Energ. (USSR), 15: 423-5(Nov. 1963). (In Russian)

In order to clarify the mechanism of the dissolution of UF_4 in water and to determine the composition of the dissolved phase, the solubility of the stable hydrate $UF_4 \cdot 2.5\ H_2O$ in water and in dilute $HClO_4$, HCl, and H_2SO_4 was determined at 0, 25, and 50°C. In order to prevent the oxidation of U^{4+}, H_2 gas was bubbled through the solution. The U content was determined by the vanadate method with phenyl anthranylic acid while the acid concentration was titrated directly. The solubility of UF_4 in water was found to be 0.0025 ± 0.0002% or $(8.0 \pm 0.8) \times 10^{-5}$ M at 0°C and 0.0050 ± 0.0005% or $(1.6 \pm 0.1) \times 10^{-4}$ M at 25°C. It was found that the solubility of UF_4 in acids increases with increasing concentration but in H_2SO_4 systems beyond 3 to 4 M the solubility decreased again, probably because the complexing ability of U with HSO_4^- is smaller than with the SO_4^{2-} ion. In $HClO_4$ the dissolution was controlled by the H^+ ions because of the complexing ability of the ClO_4^- ion. At low concentrations the solubility in the 3 acids was quite similar but at higher concentrations the order of the solubility was $ClO_4^- < Cl^- < SO_4^{2-}$. The solubility products in $HClO_4$ and water were also determined. Comparison with previous data indicated that the solubility of the tetrafluorides of Th, U, and Pu increases in that order, although only very slightly. (TTT)

8341 A DEVICE FOR THE DETERMINATION OF THE SOLUBILITY OF RADIOACTIVE MATERIALS AT ELEVATED TEMPERATURES AND PRESSURES. V. V. Ivanenko, G. N. Kolodin, B. N. Melent'ev, and L. A. Pamfilova. At. Energ. (USSR), 15: 426-8(Nov. 1963). (In Russian)

Sampling of solutions exposed to high temperatures and pressures for the purpose of determining their solubility presents serious experimental difficulties, caused by the precipitation of a component. To avoid this problem, an apparatus was constructed for measuring the solubility of difficultly soluble synthetic radioactive materials without the necessity of taking samples. The liquid and the solid are placed in a closed quartz tube between two built-in filters; the system may be mixed by tilting the loop. A sensitive counting technique is used for determining the solubility. Tests were carried out at temperatures up to 200°C with solutions having a pH less than 8; loops fabricated from Nb, Ti, or other metals allow heating to higher temperatures while using liquids of higher alkalinity. The counter was protected by a Pb shield. The device was used previously for determining the solubility of Ag_2S and Fe_2O_3

in aqueous solutions at various acidities and at temperatures up to 200°C. (TTT)

8342 PREPARATION OF CERTAIN THORIUM SULFIDES BY THE INTERACTION OF THORIUM DIOXIDE WITH HYDROGEN SULFIDE. G. V. Samsonov and G. D. Dubrovskaya. At. Energ. (USSR), 15: 428-30(Nov. 1963). (In Russian)

In view of the semiconducting properties of some of the higher Th sulfides, the interaction of ThO_2 with H_2S was investigated, using a 99.8% pure oxide in a simple apparatus. The ThO_2 was heated in a porcelain boat placed in a quartz tube through which a stream of H_2S was flowing. Analysis of the sulfidization products obtained at various temperatures revealed that at 600°C the S content increases sharply, then gradually approaches the value of $ThS_{1.7}$. Between 900 and 1100° the oxysulfide ThOS was formed. Complete removal of O and formation of the pure sulfide $ThS_{1.7}$ was reached only at 1200 to 1300°C. X-ray-diffraction studies revealed that the material has a hexagonal structure with elementary cell dimensions of a = 11.045 kX and c = 3.984 kX, which is close to the tabular values of $ThS_{1.7}$. Continued sulfidization did not affect the structure. The product had a microhardness of 3.6 to 7×10^7 ohm cm, which is about twice higher than previously reported values. Tests were also carried out in a graphite boat; in that case ThOS was obtained at 800 to 1000°C. At 1300°C the brown ThS_2 was obtained. This product had a rhombic structure with lattice parameters close to those given in the literature. (TTT)

8343 THE DISPROPORTIONATION OF ZIRCONIUM TRICHLORIDE. A. G. Turnbull and J. A. Watts (Commonwealth Scientific and Industrial Research Organization, Melbourne). Australian J. Chem., 16: 947-53(Dec. 1963).

Equilibrium pressures of the reaction $2ZrCl_3(c) \rightarrow ZrCl_2(c) + ZrCl_4(g)$ measured by a cooling curve modification of the dew-point technique was fitted over the range 613–723°K, by the relation $\log_{10}p_{mm} = -6246/T + 11{\cdot}632 \pm 0{\cdot}05$ (S.D.). Derived thermochemical data are $\Delta H_{298} = 30.1 \pm 0.5$ kcal and $\Delta S_{298} = 39.1 \pm 1$ eu, consistent with estimated $\Delta Hf_{298}ZrCl_3 = -186$ kcal/mole and $\Delta Hf_{298}ZrCl_2 = 136$ kcal/mole, $S_{298}ZrCl_3 = 36.4$ eu and $S_{298}ZrCl_2 = 28.3$ eu. (auth)

8344 SQUARE WAVE POLAROGRAPHY OF URANIUM(VI). I. AQUEOUS SOLUTIONS OF ACETYLACETONE. Lj. Jeftić and M. Branica (Inst. "Ruder Bošković," Zagreb). Croat. Chem. Acta, 35: 203-10(1963).

Complex uranyl acetylacetonato species in aqueous solution are reduced with different sensitivity if square wave polarographic techniques are used. From the plot of uranyl S. W. peak height vs the free ligand concentration, the consecutive stability constants were obtained as: $\log K_1 = 7.5$, $\log K_2 = 4.8$, and $\log \beta_2 = 12.3$. A study was made of the specific influence of acetylacetone concentration on the S. W. peak height of different uranyl species present in the solution. Acetylacetone molecules seem to form an adsorption layer on the surface of the mercury drop, which is specifically penetrable. On the basis of this assumption the overall stability constant of uranyl acetylacetonato complexes was determined as $\log \beta_2 = 12.5$. All measurements were made in 1.0 M $NaClO_4$ as supporting electrolyte. (auth)

8345 SQUARE WAVE POLAROGRAPHY OF URANIUM(VI). II. INFLUENCE OF SURFACE ACTIVE AGENTS. Lj. Jeftić and M. Branica (Inst. "Ruder Bošković," Zagreb). Croat. Chem. Acta, 35: 211-15(1963).

The influence of surface active agents on the square wave polarographic behavior of uranyl acetylacetone was investigated. Tritone-X-100 decreases specifically the S. W. peak height of each uranyl-acetylacetonato species, the adsorption layer is specifically penetrable by each one. From this specific depression the overall stability constant of uranyl acetylacetonato complexes, in 1 M sodium perchlorate, was calculated as $\log \beta_2 = 12.5$. Electrocapillary curves for T-X-100 and acetylacetone are also presented. (auth)

8346 ELECTROKINETIC STUDIES IN DISPERSE SYSTEMS. VII. ION EXCHANGE AND THE ELECTROKINETIC POTENTIAL OF PRECIPITATES OF SILVER IODIDE. V. Pravdić, Z. Jović, and M. Mirnik (Inst. "Ruder Bošković," Zagreb). Croat. Chem. Acta, 35: 239-45(1963).

A systematic study of the influence of exchange of ions on the surface of silver iodide precipitates on the electrokinetic potential (EKP) was undertaken. Examples of the exchange of ions of valencies 1:2, 1:3, 1:4, 2:4, and 3:4 are given. At higher activity of potential determining ions in solution, at pI = 3, larger changes in the EKP were measured. At the same pI effects of specific adsorption of Th^{4+} were found. The conclusion is drawn that the exchange of ions at the surface bears no direct, simple relation to the EKP. (auth)

8347 ELECTROKINETIC STUDIES IN DISPERSE SYSTEMS. VIII. THE ELECTROKINETIC POTENTIAL OF NONSTOICHIOMETRIC URANIUM OXIDES IN AQUEOUS MEDIA. V. Pravdić and S. Šotman (Inst. "Ruder Boškovićs," Zagreb). Croat. Chem. Acta., 35: 247-54(1963).

The electrokinetic potential was measured for uranium oxide samples of different atomic ratios O/U, ranging from 2.00 to 2.45. It was found that the differences in the oxidation states correspond to small but significant differences of the electrokinetic potential, with higher values for lower oxidation states. The reversal of sign was observed for positive suspensions at pH = 3.3 by the phosphate counter ion. The electrokinetic potential was found to be independent of the U^{6+}/U^{4+} ratio in the solution, indicating that these ions are not potential determining. (auth)

8348 EMPIRICAL DETERMINATION OF RELATIVE ATOMIC WEIGHT OF ELEMENTS AND THE MASS OF THEIR ISOTOPE. F.-A. Abadie-Maumert. Energie Nucl., 5: 526-32(Nov. 1963). (In French)

The decimal variations (d) of relative atomic weights (M) in the form d = M – A + 1, are graphically represented as a function of the mass number A by 5 linear segments. The equations of these segments are statistically determined, and a list of d values established for A between 3 and 240. The values of the empirical relative atomic weights $M_{(A)}$ obtained by the formula M = A + d – 1 for mass of different isotopes and the values recommended by the "Nuclear Data Tables" for the abundance of different stable natural isotopes correspond satisfactorily with the relative atomic weights, except for hydrogen and helium. The relative influence of proton and neutron number is very little and, in most practical cases, the method consequently presents sufficient precision for the determination of any isotope mass. The importance of the binding energy is shown. (auth)

8349 ISOTOPE EXCHANGE BETWEEN HYDROGEN AND WATER. E. G. Mahadevan (Indian Inst. of Tech., Madras). Indian J. Chem., 2: 1-5(Jan. 1964).

The isotope exchange of deuterium between hydrogen and water was investigated at pressures of less than 1 atm on a Pd-active charcoal catalyst and compared with para-hydrogen conversion to ortho-hydrogen and oxyhydrogen combustion under similar experimental conditions. Based on the

experimental data obtained, a tentative reaction mechanism is proposed for the isotope exchange reaction. The results indicate that the three reactions proceed by catalytic activation of the reactant gas (hydrogen and deuterium). Only for the isotope exchange reaction, homolytic dissociation of deuterium into atoms seems necessary. (TCO)

8350 FLOW STRESSES ON THE {100} AND {110} PLANES IN LiF, AND THE PLASTICITY OF POLYCRYSTALS. D. W. Budworth and Joseph A. Pask (Univ. of California, Berkeley). J. Am. Ceram. Soc., 46: 560-1(Nov. 1963). (UCRL-10919)

Compression studies of single crystals of LiF were made to determine the flow stress on the {110} (110) and {100} {110} families of slip systems as a function of temperature, and polycrystalline specimens were studied in compression in order to obtain accurate values of stress and strain to be attached to the deformation curves. Owing to the large grain size of the polycrystalline specimens it was found that the yield stress depended on the precise orientation of the most favorably oriented grain, and a better quantitative measure of behavior was provided by noting the stress necessary to produce 2% deformation. A plot of the stress as a function of temperature shows a distinct step between 350 and 400°C, and it tends to extrapolate to zero or a very low stress at the melting temperature of 842°C. Experiments on single crystals showed that the flow stress on the {110} plane decreases only slowly as the temperature is raised, but the flow stress on the {100} plane decreases sharply to 400°C and less quickly thereafter. Both curves tend to extrapolate to zero or a very low stress at the melting point, but the flow stress on the {100} plane always tends to be higher than that on the {110} plane. (P.C.H.)

8351 DETERMINATION OF NUCLEAR QUADRUPOLE COUPLING CONSTANTS FROM NUCLEAR MAGNETIC RESONANCES IN POLYCRYSTALLINE SOLIDS. P. A. Casabella (Rensselaer Polytechnic Inst., Troy, N. Y.). J. Chem. Phys., 40: 149-52(Jan. 1, 1964).

The line shape of a nuclear magnetic resonance in a polycrystalline solid under the influence of an axially symmetric second-order nuclear quadrupole perturbation was calculated for 20 values of the quadrupole coupling constant. From these calculations the frequency difference between the peaks in the derivative of the resonance line was found as a function of the quadrupole coupling constant. This relation is shown to be useful in two cases. First, a procedure is described for determining the quadrupole coupling constant by studying the resonance as a function of magnetic field, when it is known that the electric-field-gradient asymmetry parameter is zero. Second, when both first- and second-order quadrupole effects can be observed in a polycrystalline solid, a method is described for determining both the quadrupole coupling constant and the electric field gradient asymmetry parameter for small values of the asymmetry parameter. (auth)

8352 STATISTICAL TREATMENT OF GADOLINIUM AND THORIUM HYDRIDES. David P. Schumacher (Univ. of Pittsburgh). J. Chem. Phys., 40: 153-5(Jan. 1, 1964).

An expression is derived for the hydrogen pressure over a metallic hydride that exhibits two plateau regions. The isotherms for the Gd–H_2 and Th–H_2 systems are calculated. Energy terms allow for vacancy–vacancy interactions and for the expansion or contraction of the lattice upon hydride formation. The calculated value for the expansion energy in GdH_3 is -498 ± 28 cal/mole and in $ThH_{3.5}$ – 269 ± 66 cal/mole. (auth)

8353 MICROWAVE SPECTRUM OF LITHIUM CHLORIDE. David R. Lide, Jr. (National Bureau of Standards, Washington, D. C.), P. Cahill, and L. P. Gold. J. Chem. Phys., 40: 156-9(Jan. 1, 1964).

The rotational transitions $J = 0 \rightarrow 1$ in the three lowest vibrational states of Li^7Cl^{35} and the two lowest vibrational states of Li^7Cl^{37} were measured at a temperature of 600 to 800°C. The molecular constants (in Mc/sec) for Li^7Cl^{35} are: $B_e = 21181.1 \pm 0.1$, $\alpha_e = 240.2 \pm 0.2$, $\gamma_e = 1.2 \pm 0.2$; those for Li^7Cl^{37} are: $B_e = 20989.9 \pm 0.1$, $\alpha_e = 236.9 \pm 0.2$. The internuclear distance is $r_e = 2.02067 \pm 0.00006$ Å. (The uncertainties represent maximum limits of error.) A combination of the results with molecular beam electric resonance data yields a dipole moment $\mu_v = 7.075 + 0.0885\ (v + \frac{1}{2})$ D for Li^6Cl^{35}. Two high-temperature microwave spectrometers of new design are described briefly. A tabulation of molecular constants for the complete series of alkali halide molecules is included. (auth)

8354 MAGNETIC SUSCEPTIBILITY OF PRASEODYMIUM OXIDES. Sanford Kern (Purdue Univ., Lafayette, Ind. and Massachusetts Inst. of Tech., Lexington). J. Chem. Phys., 40: 208-12(Jan. 1, 1964).

Magnetic susceptibility measurements were made on Pr_2O_3, $PrO_{1.72}$, $PrO_{1.83}$, and PrO_2 from liquid-helium to room temperatures. The results are interpreted in terms of the crystal fields acting upon the cation for Pr_2O_3 and PrO_2. For these two compounds, D_{3d} symmetry was assumed for the disposition of oxygen ions about the cation, in order to explain the susceptibility results. A total crystal field splitting of 935 cm^{-1} was obtained for the ground multiplet of PrO_2 and 1383 cm^{-1} for Pr_2O_3. (auth)

8355 ON THE MAGNETIC SUSCEPTIBILITY OF XENON TETRAFLUORIDE. Edward A. Boudreaux (Louisiana State Univ., New Orleans). J. Chem. Phys., 40: 229-32 (Jan. 1, 1964).

The magnetic susceptibility of XeF_4 was treated theoretically in the LCAO–MO approximation with particular emphasis placed on the calculation of the high-frequency elements in the paramagnetic part of the susceptibility. The results are in good agreement with a recently observed susceptibility value and suggests that a previously proposed MO scheme is consistent in accounting for the magnetic properties of the molecule. A small ring current was also calculated, thus substantiating the delocalized MO description advanced by others. (auth)

8356 NATURE OF THE TWO-ELECTRON CHEMICAL BOND. IV. NATURAL ORBITALS FOR He_2^{++}. Harrison Shull and Franklin Prosser (Indiana Univ., Bloomington). J. Chem. Phys., 40: 233-5(Jan. 1, 1964).

Natural orbital expansion coefficients are presented for the function calculated by Fraga and Ransil. It was concluded that the relative minimum and maximum in the energy as a function of distance is not accompanied by significant alterations in bonding character other than those to be expected by normal distance variation. The perturbation of $He^+ + He^+$ by $He + He^{2+}$ is therefore small. (auth)

8357 MASS-SPECTROMETRIC DETERMINATION OF THE DISSOCIATION ENERGY OF THE MOLECULES Sc_2, Y_2, La_2, AND YLa. G. Verhaegen, S. Smoes, and J. Drowart (Université Libre, Brussels). J. Chem. Phys., 40: 239-41(Jan. 1, 1964).

Dissociation energies of Sc_2, Y_2, La_2, and YLa were calculated by the absolute-entropy method. Pressure-independent reactions $Me_2(g) \rightarrow Me(g) + Me(s)$ were considered, using $L_0^0(Y) = 97.6$ and $L_0^0(La) = 104.1$ kcal/mole. The free-energy functions of Sc_2, Y_2, and La_2 were calculated using

an effective quantum weight of 5, a vibration frequency of 230 cm^{-1}, and 2.70, 2.80, and 2.80 Å, respectively, as interatomic distances. For YLa the values of Y_2 and La_2 were averaged and corrected for the absence of symmetry. The numerical values (in cal/deg·mole) for Sc_2, Y_2, La_2, and YLa are, respectively; −68.3, −72.3, −74.1, and −74.6 at 2000°K, and −69.6, −73.6, −75.4, and −76.0 and 2300°K. The dissociation energies of Sc_2, Y_2, and La_2 are of the same magnitude as those of Cu_2, Ag_2, and Au_2; 45.5, 37.6, and 51.5 kcal/mole, respectively. (P.C.H.)

8358 ELECTRONIC STRUCTURE AND SPECTRUM OF XeF_4. A SEMIEMPIRICAL MO TREATMENT. Edward A. Boudreaux (Louisiana State Univ., New Orleans). J. Chem. Phys., 40: 246-7(Jan. 1, 1964).

Standard group theoretical methods were used in deriving various molecular-orbital combinations for XeF_4. Spectral characteristics ascribed to symmetry-allowed singlet-singlet transitions are given. The effective charge on Xe in XeF_4 was computed to be 0.412, and is in good agreement with that inferred from NMR data. The ionization potential (13.2 ev) estimated from the data also seems reasonable. (P.C.H.)

8359 LINEAR THERMAL EXPANSION COEFFICIENT OF THE NaCl PHASE OF CsCl. J. M. Christian and D. W. Lynch (Ames Lab., Ames, Iowa). J. Chem. Phys., 40: 248 (Jan. 1, 1964). (IS-729)

The linear thermal-expansion coefficient of the low-temperature phase of CsCl, $\alpha(T) = \Delta l/l(T)\Delta T$, where T is the average temperature in the interval ΔT, was determined to be 4.78×10^{-5} $(C°)^{-1}$, between 50 and 150°C. The average expansion coefficient between 570 and 590°C in the NaCl phase was 5.1×10^{-5} $(C°)^{-1}$ with an estimated error of 10% based on the reproducibility. Just below the phase change the lattice parameter expansion coefficient is 6.6×10^{-5} $(C°)^{-1}$ and the NaCl phase is seen to have a lower expansion coefficient than the more closely packed CsCl phase. (P.C.H.)

8360 NEW COMPOUNDS IN WHICH TECHNETIUM HAS A LOW VALENCY. J. D. Eakins, D. G. Humphreys, and C. E. Mellish (Wantage Research Lab., Berks, Eng.). J. Chem. Soc: 6012-16(Dec. 1963).

By reduction of technetium in the quadrivalent state with hydroxylamine, the chloride of a complex cation was isolated containing bivalent technetium, with hydroxylamine and ammonia as ligands. Reduction with zinc and concentrated hydrochloric acid gave an ill-defined amorphous compound from which yttrium, ammonium, and potassium salts with an anion $[Tc_2Cl_8]^{3-}$ were prepared. Other reduction products of technetium were also obtained, and it is suggested that technetium may have a fairly extensive solution chemistry in its lower valency states. (auth)

8361 THE REACTION OF TITANIUM(IV) AND ZIRCONIUM(IV) HALIDES WITH SOME BIDENTATE LIGANDS. G. W. A. Fowles and R. A. Walton (Univ. of Southampton, Eng.). J. Less-Common Metals, 5: 510-12 (Dec. 1963).

Titanium(IV) and zirconium(IV) bromide and chloride complexes with bipyridyl and 1,10-phenanthroline were prepared and those found to be diamagnetic are: $TiCl_4$, bipyr; $TiBr_4$, bipyr; $ZrCl_4$ bipyr; $ZrBr_4$, bipyr; $ZrCl_4$, phen; $ZrBr_4$, phen. The compounds were slightly soluble in methyl cyanide, and conductivity measurements on such solutions showed that the compounds were essentially non-ionic. The molar conductivities of the Zr complexes were appreciably higher than that found for the bipyridyl complex formed by Ti(IV) chloride, but very much less than the value obtained for the 1:1 electrolyte Et_4NBr at the same concentration (~10^{-3} M). The pyridine complex of Ti(III) chloride, $TiCl_3$, 3py, behaves as a 1:1 electrolyte in methyl cyanide. The preparation methods are given. (P.C.H.)

8362 THE RELATIVE FREE ENERGIES OF SODIUM, POTASSIUM, RUBIDIUM, CESIUM, AND STRONTIUM IONS IN METHANOL AND METHANOL–WATER MIXTURES. Kenneth Schug and Ahmad Dadgar (Illinois Inst. of Tech., Chicago). J. Phys. Chem., 68: 106-11(Jan. 1964).

The equilibrium $Na(Hg) + 1/nM^{n+}(S) = Na^+(S) + 1/nM(Hg)$ was measured for M = K, Rb, Cs, and Sr, and S = 0.30, 0.80, and 1.00 mole fraction methanol (and for Sr also at 0.90 and 0.95 mole fraction methanol) in water-methanol mixtures. The results were combined with those from similar measurements using water as solvent to yield the standard free energy values for the reaction $Na^+(H_2O) + 1/nM^{n+}(S) = Na^+(S) + 1/nM^{n+}(H_2O)$. The results, when compared with the predictions of the simple Born equation, lead to the conclusion that specific cation solvation effects are of primary importance in determining the relative free energies of the alkali metal ions in these systems. It is also shown that calculations based on a simple ion–dipole model lead to values in reasonable agreement with experiment. (auth)

8363 ABSORPTION SPECTRA OF THE ALKALI METALS IN ETHYLENEDIAMINE. Robert R. Dewald and James L. Dye (Michigan State Univ., East Lansing). J. Phys. Chem., 68: 121-7(Jan. 1964).

The absorption spectra of the alkali metals in ethylenediamine and the spectra of mixtures of various alkali metal ions with metal solutions are reported. The absorption spectra differ markedly from one metal to another. The species responsible for the various absorption peaks are only slowly interconverted. It was concluded that three types of species are responsible for light absorption, and the presence or absence of any type is a characteristic of the metal. (auth)

8364 SOLUBILITIES AND CONDUCTANCES OF ALKALI METALS IN ETHYLENEDIAMINE. Robert R. Dewald and James L. Dye (Michigan State Univ., East Lansing). J. Phys. Chem., 68: 128-34(Jan. 1963).

The conductances of cesium, rubidium, potassium, and sodium in ethylenediamine were measured at room temperature as a function of concentration. The equivalent conductance for solutions of cesium, potassium, and rubidium showed the same general concentration dependence while that for sodium solutions exhibited a marked difference in behavior. The apparent limiting values of the equivalent conductances of cesium, potassium, and rubidium solutions were evaluated using the Shedlovsky conductance function, and values of 204, 139, and 117 kohlrausch units, respectively, were obtained. The solubilities of the alkali metals in ethylenediamine were also determined. (auth)

8365 A MODEL FOR METAL–AMINE SOLUTIONS. James L. Dye and Robert R. Dewald (Michigan State Univ., East Lansing). J. Phys. Chem., 68: 135-42(Jan. 1964).

A general model is proposed to describe the nature of metal–amine solutions. Three types of species are suggested: solvated electrons similar to those in metal–ammonia solutions are responsible for the infrared absorption band and are the main contributors to the conductivity; covalent dimers, similar to those existing in the gas phase for the alkali metals, form in solutions of K, Rb, and Cs and are responsible for the intermediate absorption; and combination of a solvated molecule-ion,

M_2^+, with an electron trapped in the field of this ion gives rise to the absorption at 650–750 mμ commonly found in metal–amine solutions. Semiquantitative thermodynamic calculations are presented that lend support to the model proposed and help to explain the diversity of behavior observed for the different alkali metals in a variety of solvents. (auth)

8366 THE DENSITY OF LIQUID T_2O. Maxwell Goldblatt (Los Alamos Scientific Lab., N. Mex.). J. Phys. Chem., 68: 147-51(Jan. 1963). (LADC-5891)

The density of 99.30 mole% T_2O was determined from 5 to 54°C to ±0.015% by a magnetic float method. The density of 100% T_2O depends on temperature according to $D = 1.213124 + 2.9129 \times 10^{-4}t - 1.1954 \times 10^{-6}t^2 + 5.301 \times 10^{-9}t^3$ g/cm³. The maximum density, 1.21502 g/cm³, occurred at 13.4 ± 0.1°. Molar volumes were compared with those of H_2O and D_2O. The concentration of T_2O_2 in 98% T_2O was found to be 0.001 – 0.002 mole/l. (auth)

8367 ON THE SYSTEM NIOBIUM PENTOXIDE–TANTALUM PENTOXIDE. G. P. Mohanty, L. J. Fiegel, and J. H. Healy (A. O. Smith Corp., Milwaukee). J. Phys. Chem., 68: 208-10(Jan. 1964).

Phase equilibria in the system Nb_2O_5–Ta_2O_5 were investigated. The results generally support the equilibrium diagram previously proposed for the Nb_2O_5–Ta_2O_5 system. However, some discrepancies remain. First of all, the compound $2Nb_2O_5 \cdot Ta_2O_5$ was found to have limited solubility, especially for Ta_2O_5. For example, in samples annealed at 1435°C, the presence of α-Ta_2O_5 marking the compositional limit of $2Nb_2O_5$. Ta_2O_5 was detected only beyond the 36% Ta_2O_5 composition. Also the temperature where $2Nb_2O_5 \cdot Ta_2O_5$ undergoes the eutectoid transformation to α-Nb_2O_5 and β-Ta_2O_5 appears to be lower than previously indicated. (P.C.H.)

8368 FORMATION OF COMPLEX COMPOUNDS BETWEEN URANYL NITRATE AND THE NITRATES OF THE FIRST GROUP ELEMENTS. THE SYSTEM: $Cu(NO_3)_2$ – $UO_2(NO_3)_2$ – H_2O (CONDUCTIVITY, REFRACTIVE INDEX, COLORIMETRY AND pH). S. S. Gupta and B. N. Sharga (Lucknow Univ., India). J. Prakt. Chem. (4), 22: 101-7 (Oct. 1963).

Experiments with the copper nitrate–uranyl nitrate–water system, viz., conductivity, refractive index, colorimetry, and pH, revealed the existence of the two complex compounds in solution in the (1 : 1) and (1 : 2) molar ratios. (auth)

8369 KINETICS OF ISOTOPE REDISTRIBUTION REACTIONS. H. Bolder, G. Dallinga, and H. Kloosterziel (Koninklijke Shell-Laboratorium, Amsterdam). Nature, 200: 1316-17(Dec. 28, 1963).

The redistribution rate law for isotope reactions is defined by the equation $u_2 - u_2(\infty) = [u_2(0) - u_2(\infty)] \exp(-A'k't)$. The equation holds for a stepwise process, that is, one proceeding by consecutive reactions, or for any process in which only one isomer D_2 (and, consequently, D_{N-2}) exists, as in the case of methane. (P.C.H.)

8370 EQUILIBRIUM PRESSURES IN THE SYSTEM Th_2Al–HYDROGEN. J. H. N. van Vucht. Philips Res. Rept., 18: 1-20(Feb. 1963).

For reasons of theoretical and practical importance pressure isotherms are measured of hydrogen in equilibrium with its solid solutions in the getter metal Th_2Al. From these measurements thermodynamic data are obtained, which permit comparison of the stabilities of the hydrogen solutions with those of other getter hydrides. The isotherm at about 225°C shows three points of inflexion, at compositions of about $Th_2Al_4H_5$, $Th_2Al_4H_9$, and $Th_2Al_4H_{13}$. Those at $Th_2Al_4H_5$ and $Th_2Al_4H_{13}$ are considered as remnants of plateaux and indicate a tendency to phase-separation in the solid solution. The effect of replacing some of the thorium atoms in Th_2Al by cerium atoms is an increase of hydride stability, together with the appearance of real plateaux. (auth)

8371 ELECTRONIC TRANSPORT IN SEMIMETALLIC CERIUM SULFIDE. M. Cutler, J. F. Leavy, and R. L. Fitzpatrick (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev., 133: A1143-52(Feb. 17, 1964).

The electric resistivity ρ and Seebeck coefficient S were measured between 10 and 1,000°K in $Ce_{3-x}S_4$ with values of x ranging from 0 to 0.30. The electric behavior is semimetallic and can be fitted, in large measure, to the equations of conventional transport theory for S(T) and ρ(T). However, examination of the electrostatic effects of the vacancies shows that they introduce large effective charges that are poorly screened. Consequently, there are wide fluctuations in potential in the crystal that cast doubt on a literal interpretation of the theoretical equations; at present, they must be regarded as providing a largely empirical description of the experimental results. There is a relatively large residual resistivity, which indicates a very large cross section per vacancy in samples with small values of x. This can be accounted for by the abnormally large screening distance. In the temperature range below 100°K, anomalies are observed in S(T) and ρ(T) in samples with small vacancy concentrations. Anomalies in S(T) seem to be caused by phonon drag. The cause of the resistivity anomalies is not yet clear; the possibilities that they are caused by local lattice vibrations or by spin scattering by electrons in the $4f$ shell of the cerium ions are considered. (auth)

8372 ELECTRONIC TRANSPORT IN HIGH-RESISTIVITY CERIUM SULFIDE. M. Cutler and J. F. Leavy (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Phys. Rev., 133: A1153-62(Feb. 17, 1964).

Electronic transport was studied in $Ce_{3-x}S_4$ samples with compositions in the range $x > 0.30$. The results show systematic trends as a function of temperature and composition that suggest a transition between behavior typical of metals and behavior typical of insulators. The resistivity curves as a function of temperature generally go through a minimum and have an activation energy in the low-temperature range. The Seebeck coefficient and Hall coefficient also show systematic changes suggesting a division into two characteristic transport ranges. The low Hall mobility at low temperatures and the behavior of the Seebeck coefficient support the idea that the electrons are in localized states in the semi-insulator region and move by a hopping process. (auth)

8373 EXCHANGE CORRELATIONS IN STATISTICAL MODEL AND EQUATION OF STATE OF ELEMENTS AT HIGH PRESSURES. S. Olszewski (Inst. of Physical Chemistry, Polish Academy of Sciences, Warsaw). Phys. Status Solidi, 3: 2305-7(1963).

The equation of state of elements under high pressures (10^{10} to 10^{14} dyn-cm^{-2}) was investigated using a statistical model. The data are compared with the Thomas-Fermi and Thomas-Fermi-Dirac theories and also with experiments. The statistical model, in general, predicts that the pressures needed to obtain a given macroscopical density of an element are greater than those obtained from

the Thomas-Fermi-Dirac theory. This agrees with experiment in the pressure region from 10^{11} to above 10^{12} dyn-cm^{-2}. (auth)

8374 GAS-SOLID CONTACTING. J. E. Lloyd (United Kingdom Atomic Energy Authority, Springfields, Lancs, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 371-407(1963).

Some achievements of European workers in gas–solid contacting are discussed in the light of new techniques. Equipment used in gas–solid contacting is reviewed and classified according to application. The various European processes for uranium fluoride production are reviewed. 70 references. (R.E.U.)

8375 PRODUCTION OF URANIUM, THORIUM, PLUTONIUM, AND THEIR COMPOUNDS. Reactor Fuel Process., 6: No. 4, 53-8(1963).

Developments in fluid-bed reduction of uranium trioxide, coating of uranium dioxide particles, preparation of U(IV) nitrate solutions, electrodeposition of plutonium from molten-salt solutions of Cs_2PuCl_6, bomb reduction of plutonium chloride and plutonium fluoride, and design of plutonium facilities are described. (18 references) (M.C.G.)

8376 THERMAL DECOMPOSITION OF RARE EARTH METAL OXALATES. I. OXALATES OF LANTHANUM, PRASEODYMIUM AND NEODYMIUM. S. S. Moosath, John Abraham, and T. V. Swaminathan (Univ. of Kerala, Trivandrum, India). Z. Anorg. Allgem. Chem., 324: 90-5(Aug. 1963).

Thermal decomposition studies of the oxalate-hydrates of lanthanum, praseodymium, and neodymium on a Stanton thermobalance showed that these form a group, giving stable intermediate products (basic carbonates) before final decomposition to the oxide. Intermediate weight levels corresponding to lower hydrates were not obtained. The final stage of dehydration of these oxalates was followed by rapid decomposition, indicating that the anhydrous oxalates are unstable. The mechanism of decomposition of lanthanum oxalate was investigated in detail. A modified decomposition procedure on the thermobalance showed that anhydrous lanthanum oxalate is fairly stable at 300°C. (auth)

8377 THERMAL DECOMPOSITION OF RARE EARTH METAL OXALATES. II. OXALATES OF SAMARIUM, EUROPIUM, GADOLYNIUM, TERBIUM AND DYSPROSIUM. S. S. Moosath, John Abraham, and T. V. Swaminathan (Univ. of Kerala, Trivandrum, India). Z. Anorg. Allgem. Chem., 324: 96-8(Aug. 1963).

Thermal decomposition of the hydrated oxalates of Sm, Eu, Gd, Tb, and Dy was carried out on a Stanton thermobalance. The oxalates after precipitation were dried at 110°C for six hours and then used for the decomposition studies. No indications of the formation of stable lower hydrates or of intermediate basic carbonates were obtained. Weight levels corresponding to oxide formation were found in the temperature range 690 to 720°C. (auth)

8378 THERMAL DECOMPOSITION OF RARE EARTH METAL OXALATES. III. OXALATES OF HOLMIUM, ERBIUM, THULIUM, YTTERBIUM, LUTETIUM AND YTTRIUM. S. S. Moosath, John Abraham, and T. V. Swaminathan (Univ. of Kerala, Trivandrum, India). Z. Anorg. Allgem. Chem., 324: 99-102(Aug. 1963).

Thermal decompositions of the oxalates of the heavy rare earth metals and of yttrium were carried out on a Stanton thermobalance. These oxalates on precipitation and drying at 110°C for six hours, gave the trihydrates, which were used in the decomposition studies. Dihydrates, stable in the temperature range 230 to 330°C, were formed before complete dehydration. Maximum decomposition was found to take place between 400 to 460°C. Weight levels corresponding to oxide formation were obtained in the temperature range 680 to 700°C without any indication of formation of intermediate products. (auth)

8379 THERMAL DECOMPOSITION OF RARE EARTH METAL OXALATES. IV. OXALATES OF CERIUM AND THORIUM. S. S. Moosath, John Abraham, and T. V. Swaminathan (Univ. of Kerala, Trivandrum, India). Z. Anorg. Allgem. Chem., 324: 103-5(Aug. 1963).

The thermal decomposition of the hydrated oxalates of cerium(III) and thorium was studied by means of a Stanton thermobalance. The thermolysis pattern of cerium oxalate showed an anomalous behavior differing from that of other rare-earth metal oxalates. Constant weight levels corresponding to lower hydrates were not obtained. Several points of resemblances were noticed in the decomposition patterns of cerium oxalate and thorium oxalate. Formation of thorium oxalate monohydrate at 140°C, as reported, was observed during these studies. (auth)

8380 XENON DIFLUORIDE, XeF_2. R. Hoppe, H. Mattauch, R. M. Roedder, and W. Daehne (Universitat, Munster, Ger.). Z. Anorg. Allgem. Chem., 324: 214-24(Sept. 1963). (In German)

By subjection to discharges from an induction coil, mixtures of xenon and fluorine yielded xenon difluoride, XeF_2, which condensed on a cool finger (–78°C). XeF_2 is colorless, has a characteristically nauseating odor, shows birefringence, is diamagnetic, and sublimes without decomposition. (auth)

8381 POLAROGRAPHIC INVESTIGATION IN MOLTEN ALKALI CHLORIDE MIXTURES. II. USE OF A DROPPING BISMUTH ELECTRODE IN THE LiCl–KCl EUTECTIC. K. Schwabe and R. Ross (Technische Universitat, Dresden and Zentralinstitut fur Kernphysik, Rossendorf, Ger.). Z. Anorg. Allgem. Chem., 324: 191-5(Oct. 1963). (In German)

Using a dropping Bi electrode, the polarographic behavior of heavy-metal ions in the molten LiCl–KCl eutectic was investigated at 450°C. The half-wave potentials are given. An estimation of the Nernst factors showed that the Heyrovsky-Ilkovic equation is valid. (auth)

8382 SATURATION VAPOR PRESSURE IN $SmCl_2$, $EuCl_2$, AND $YbCl_2$. O. G. Polyachenok and G. I. Novikov (Leningrad State Univ.). Zh. Neorgan. Khim., 8: 2631-4 (Dec. 1963). (In Russian)

A method was developed for $EuCl_2$ and $YbCl_2$ synthesis by reducing tri-chlorides with metallic zinc. The boiling point method was used for measuring saturated vapor pressure in $SmCl_2$, $EuCl_2$, $YbCl_2$ (1200 to 1400°) and metallic samarium (1100 to 1350°C). Thermodynamic approximation confirmed the evaporation of Sm, Eu, and Yb dichlorides without decomposition. (R.V.J.)

8383 REACTIONS OF TANTALUM, NIOBIUM, IRON, AND ALUMINUM CHLORIDES WITH TIN CHLORIDES. I. S. Morozov and Ch'ih-fa Li. Zh. Neorgan Khim., 8: 2733-6(Dec. 1963). (In Russian)

Constitution diagrams were constructed for $SnCl$–$NbCl_5$, $SnCl_4$–$TaCl_5$, $SnCl$–$FeCl_3$, $SnCl_4$–$AlCl_3$ and ternary systems $NbCl_5$–$TaCl_5$, $SnCl_4$–$FeCl_3$–$AlCl_3$, $SnCl_4$–$NbCl_5$–$AlCl_3$, $SnCl_4$–$TaCl_5$–$AlCl_3$, and $SnCl_4$–$NbCl_5$–$FeCl_3$. It was shown that niobium pentachloride can be easily reduced at 200°C by $SnCl_2$ into niobium tetra- and trichloride. (R.V.J.)

8384 HYDRATE COMPOUNDS IN UO_3–WATER SYSTEM. E. Ya. Rode, Z. S. Golovleva, V. G. Kuznetsov, and

P. A. Koz'min (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Zh. Neorgan. Khim., 8: 2751-72(Dec. 1963).

Physicochemical studies were made of hydrated uranium trioxide synthesized at various conditions. Reactions of uranium trioxide with water at room to 50° temperature formed $\beta-UO_3 \cdot 2H_2O[\beta-UO_2(OH)_2 \cdot H_2O]$ bihydrate with rhombic lattice. Isothermal dehydration of $\beta-UO_3 \cdot 2H_2O$ in the air at 70°C formed $\beta-UO_3$ (2 to 1.5) H_2O. Further dehydration of the bihydrate formed monohydrate $\alpha-UO_3 \cdot H_2O[\alpha-UO_2(OH)_2]$ with a rhombic face-centered lattice at 100° and a solid solution $\alpha-UO_3$ (1 to 0.72) H_2O at 200°C. (R.V.J.)

8385 SORPTION OF URANIUM(VI) FROM AMMONIUM CARBONATE SOLUTIONS BY ANIONITES. V. S. Pakholkov and B. F. Stikhin. Zh. Neorgan. Khim., 8: 2806-10(Dec. 1963). (In Russian)

Studies of dynamic sorption of uranium from 0.05 mole $(NH_4)_4UO_2(CO_3)_3$ solutions by ammonium carbonate anionites AB-17, EDE-10, and An-2F showed a reduced sorption with an increase of the ammonium carbonate. It was also found that fluorine ion influences uranium sorption only in low saturation ammonium carbonate solutions. Elution of sorbed uranium from $(NH_4)_4 \cdot [UO_2(CO_3)_3]$ solutions and from AB-17, EDE-10, and An-2F anionites by ammonium chloride solutions with and without additional ammonium carbonates was analyzed. (R.V.J.)

8386 THE $SmCl_3-Sm$ AND YCl_3-Y SYSTEMS. O. G. Polyachenok and G. I. Novekov (Leningrad State Univ.). Zh. Neorgan. Khim., 8: 2818-19(Dec. 1963). (In Russian)

Investigations of $SmCl_3-Sm$ and YCl_3-Y melting diagrams and saturated vapor pressure in melted YCl_3-Y showed that $SmCl_3$ melting point is found at 677° and YCl_3 at 721°C. Measurements of saturated vapor pressure analyzed by boiling point method at 1040 to 1380° showed that the heat of evaporation at 0°K is 799 kcal/mole, at boiling temperature it is 48 kcal/mole while the boiling temperature of YCl_3 is 1501°. (R.V.J.)

8387 THE $ScCl_3-Sc$ SYSTEM. O. G. Polyachenok and G. I. Novikov (Leningrad State Univ.). Zh. Neorgan. Khim., 8: 2819-21(Dec. 1963). (In Russian)

The melting point and vapor pressure isotherm (at 960°) were found for $ScCl_3-Sc$ prepared by Sc_2O_3 chlorination in chlorine saturated with CCl_4 vapor at 650 to 700°. The melting point at 953° for $ScCl_3$ and the value ΔH°_{298} −145 kcal/mole for formation of solid $ScCl_2$ were in agreement with published data. (R.V.J.)

8388 PRECIPITATION OF ZIRCONIUM DISELENITE. I. V. Tananaev and T. N. Kuz'mina. Zh. Neorgan. Khim., 8: 2821-2(Dec. 1963). (In Russian)

An analysis was made of the composition of $ZrOCl_2$ solutions with H_2SeO_3 or Na_2SeO_3 precipitated from 0.6N HCl solution. Solutions saturated with $H_2SeO_3 \sim 0.25$ mole/l formed a precipitate with zirconium diselenite while solutions with lesser amount of H_2SeO_3 contained zirconyl selenite. Thermal decomposition of zirconium diselenite (into ZrO_2 and SeO_2) takes place at 625°. (R.V.J.)

8389 ELECTRIC PROBE IN CESIUM VAPOR ATMOSPHERE. M. A. Lebedev and Yu. K. Gus'kov. Zh. Tekhn. Fiz., 33: 1462-3(Dec. 1963). (In Russian)

Investigations were made of electric probe current as functions of cathode temperature and cesium vapor pressure. The data showed that the minimum V_p is found at 0.5 mm Hg. At constant pressure the probe current strongly depends on cathode temperature. At $T_c \geq 800°C$, $V_p = 4$ to 5 v. The probe current increases with reduced temperature. A table of probe current vs cesium vapor pressures at various cathode temperatures is included. (R.V.J.)

8390 GRAPHITE OXIDATION AT LOW TEMPERATURE. Edward Effron. Thesis, Baltimore, Johns Hopkins Univ., 1962. 160p.

Graphite oxidation studies have been carried out in O and in air between 400° and 530°C. An analytical system capable of detecting product carbon dioxide and carbon monoxide at concentrations less than 10 ppm was developed. Kinetic results are compared with literature data obtained under similar conditions. The effect of particle size on oxidation rate and product distribution is considered. A reaction mechanism is proposed which reconciles much of the published data and the results reported herein. (Dissertation Abstr.)

8391 DEUTERIUM ISOTOPE EFFECTS IN TWO-PHASE LIQUID SYSTEMS CONTAINING WATER. C. U. Linderstroem-Lang (Forsøgsanlaeg Risø, Roskilde, Denmark). Vienna, International Atomic Energy Agency, 1963, Preprint SM-50/6, 22p. (CONF-269-12)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

It is shown, on the basis of a previous study of the water triethylamine system, how the following approximate relations may be obtained: $RT\,[y'' - y'/y(1-y)] = -1/2\,(d\mu'_w/dy')_{eq,T} = -1/2\,\Delta H'_w/T\,(dT/dy')_{eq,x'}$. y' and y'' are isotopic compositions of the organic phase and the water phase, respectively: so $[y'' - y'/y(1-y)]$ is the isotope effect. μ'_w is the chemical potential of total water in the organic phase and $\Delta H'_w$ is the partial molar enthalpy of mixing; subscript eq. indicates equilibrium between the two phases. The dependence of $(d\mu'_w/dy')_{eq,T}$ on the solubility difference is discussed and a comparison is made between the first equation and Duhem-Margules equation valid for the binary system containing liquid light and heavy water in equilibrium with their vapors. A justification for simplifications used to obtain the equations is given and the limitations of the applicability of the relations are discussed. It is shown that the large solubility differences encountered simply are sensitive indicators of rather small changes in solution structure. So the conclusion is drawn that the physical process of equilibrating mixtures of heavy and light water with an organic phase (excluding any effective chemical exchange) normally will lead to isotope effects of the same low order of magnitude as found for other physical processes. (P.C.H.)

8392 X-RAY DIFFRACTOMETRIC EXAMINATION OF LOW TEMPERATURE PHASE TRANSFORMATIONS IN SINGLE-CRYSTAL STRONTIUM TITANATE. Farrel W. Lytle (Boeing Scientific Research Labs., Seattle). 23p. (CONF-174-10)

From 12th Annual Conference Application of X-Ray Analysis, Denver, Aug. 1963.

The lattice parameters of single-crystal $SrTiO_3$ were determined by x-ray diffraction as a function of temperature from 4.2 to 300°K. Three significant regions were found. From 65 to 110°K a tetragonal modification exists (c/a = 1.00056), from 35 to 55°K line splitting consistent with orthorhombic symmetry was observed, and at 10°K an anomalous maximum in the lattice parameter vs temperature curve was found that suggested a third structure transformation. In the tetragonal region (at 78°K) the for-

mation of a domain structure was observed with a polarizing microscope. The low temperature x-ray technique and x-ray cryostat are described. (auth)

Organic Chemistry

8393 (TID-19989) THE DEVELOPMENT OF CHELATING AGENTS FOR ENHANCING THE URINARY EXCRETION OF STRONTIUM. Report No. 3, January 1, 1963–November 30, 1963. Harry Kroll, Vincent Elkind, and Richard David (Eltex Research Corp., Lincoln, R. I.). Dec. 9, 1963. Contract AT(30-1)-2710. 36p.

Polyaminocarboxylic acids, polyelectrolytes, ethylene glycol derivatives, aminosulfonates, and polyphosphonic acids were prepared and tested for their affinities for the alkaline earth cations Mg, Ca, and Sr. (C.H.)

8394 (TID-20013) METAL CHELATES OF MERCAPTOSUCCINIC AND α,α'-DIMERCAPTOSUCCINIC ACIDS. G. R. Lenz and A. E. Martell (Illinois Inst. of Tech., Chicago). [1967]. Contract AT(11-1)-1020. 27p.

The interactions of metal ions with α-mercaptosuccinic acid and with α,α'-dimercaptosuccinic acid with various metal ions were determined by potentiometric measurement of hydrogen ion concentration. With mercaptosuccinic acid, evidence is presented for the formation of 1:1 and 2:1 ligand-metal complexes as well as a zinc hydroxo complex. With α,α'-dimercaptosuccinic acid, the existence of 1:1 and 2:1 complexes was established, together with various protonated and hydroxo complexes. Equilibrium constants are reported for soluble metal chelate systems and the equilibrium data are interpreted in terms of probable structure of the complexes formed. (auth)

8395 (TID-20014) MIXED-LIGAND CHELATES OF THORIUM(IV). G. H. Carey and A. E. Martell (Illinois Inst. of Tech., Chicago). [1963]. Contract AT(11-1)-1020. 29p.

Mixed ligand chelates of thorium(IV) were prepared in solution and studied potentiometrically. These new compounds were formed by the reaction of various bidentate ligands with Th(IV) chelates of multidentate ligands such as ethylenediaminetetraacetic acid, cyclohexanediaminetetraacetic acid, N-hydroxyethylethylenediaminetriacetic acid, and nitrilotriacetic acid. When the stoichiometry ratios of the two ligands are such that the coordination vacancies of the metal ion are completely filled, the mixed ligand chelates thus formed are usually more stable toward hydrolysis than the analogous Th(IV) chelates containing only one type of ligand. The results obtained with a wide variety of mixed chelates of Th(IV) indicate that they may be divided into several classifications, depending on the order in which the ligands coordinate with the metal, on whether or not hydrolysis steps take place, and on whether the system disproportionates into a mixture of complexes each containing one type of ligand. (auth)

8396 (TID-20015) METAL CHELATES OF TRIETHYLENETETRAMINEHEXAACETIC ACID. T. A. Bohigian, Jr., and A. E. Martell (Illinois Inst. of Tech., Chicago). [1963]. Contract AT(11-1)-1020. 27p.

Potentiometric studies of the interaction between the decadentate chelating agent, triethylenetetraminehexaacetic acid (TTHA) and various metal ions are described. Evidence is given for the formation of Th(IV) chelate having a 1:1 ratio of Th(IV) to ligand, 1:1 and 2:1 molar ratios of Cu(II), Co(II), Ni(II), and La(III) ions to ligand, and chelates containing 1:1, 2:1, and 3:1 molar ratios of Mg(II) and Ca(II) ions to ligand. Formation constants were calculated, and probable structures of the 1:1, 2:1, and 3:1 chelates were deduced from the potentiometric data. (auth)

8397 (TID-20018) EQUILIBRIUM STUDIES OF URANYL COMPLEXES. III. INTERACTION OF URANYL ION WITH TARTARIC AND MALIC ACIDS. K. S. Rajan and A. E. Martell (Illinois Inst. of Tech., Chicago). [1967]. Contract AT(11-1)-1020. 32p.

A quantitative study of the interaction of uranyl ion with tartaric and malic acids was carried out by means of the potentiometric method in the pH range 2 to 8 at an ionic strength of 1.0 (KNO_3) and 25°. On the basis of suitable mathematical treatments of the potentiometric data obtained over twenty-five-fold range of total concentration of metal species, it is concluded that binuclear complexes are formed in the pH range 2 to 4, in which the bridging between metal ions occurs through the ligand groups. Equilibrium constants for the formation of the metal chelates and the dimerization constants were determined. The polynuclear species present in solution in the buffer region between 3 and $3\frac{2}{3}$ moles of base per mole of metal salt are found to be trimetric. Equilibrium constants for the hydrolysis of the (2:2) dimer and the formation of ternuclear complex are reported. (auth)

8398 SYNTHESIS OF 2-PHENYLISOPROPYLHYDRAZINE-1-^{14}C HYDROCHLORIDE. Lennart Eberson (Univ. of Lund, Sweden). Acta Chem. Scand., 17: 2349-50(1963).

A method for the synthesis of C^{14} labeled 2-phenylisopropylhydrazine is described. The method avoids the troublesome step of preparing the acid chloride. The over-all yield of recrystallized 2-phenylisopropylhydrazine-1-C^{14} hydrochloride from $Ba^{14}CO_3$ (starting with 3.00 mmoles of an activity of 3.33 mC/mmole) was 33%. (P.C.H.)

8399 SPECTRAL ABSORPTION PROPERTIES OF ORDINARY AND FULLY DEUTERIATED CHLOROPHYLLS a AND b. Harold H. Strain, Mary R. Thomas, and Joseph J. Katz (Argonne National Lab., Ill.). Biochim. Biophys. Acta, 75: 306-11(Nov. 29, 1963).

The spectral absorption properties of fully deuteriated chlorophylls a and b, ordinary chlorophylls a and b, and methyl chlorophyllides a and b, isolated in a state of high purity, were compared. Substitution of phytyl by methyl did not affect the wavelengths of the absorption maxima or the ratio of the absorption at the principal maxima. Deuteriation reduced the absorption in proportion to the molecular weight of the deuteriated pigments. Deuteriation also shifted the absorption maxima to slightly shorter wavelengths, an effect attributable primarily to the 6 deuterium atoms attached to C atoms in the conjugated system. (auth)

8400 ION-MOLECULE REACTIONS IN METHANE AND IN ETHANE. G. A. W. Derwish, A. Galli, A. Giardini-Guidoni, and G. G. Volpi (CNEN, Rome and Universita, Rome). J. Chem. Phys., 40: 5-12(Jan. 1, 1964).

Ion–molecule reactions in methane, methane–methane-d_4 mixture, and ethane were studied up to a pressure of 0.08 Torr in the ion source of the mass spectrometer. Ionization-efficiency curves, appearance potentials, and pressure-dependence studies allowed the parent-daughter ion relation and the cross sections of the pertinent reactions to be determined. (auth)

8401 INFRARED ABSORPTION OF THE ν_3 FUNDAMENTAL OF LIQUID AND SOLID CH_4 AND CD_4. George E. Ewing (California Inst. of Tech., Pasadena). J. Chem. Phys., 40: 179-83(Jan. 1, 1964).

The ν_3 fundamental of CH_4, CD_4, and solutions of CD_4 in CH_4 was studied in the liquid and solid state from 105 to

28°K. The broad liquid-state absorption approximates the gas-phase vibration-rotation envelope in the wings, but has significantly more absorption at the band center. This deviation is consistent with the assumption that molecules in the liquid can undergo hindered rotation. One consequence of this model is that rotatory motion of molecules is in part librational in character and selection rules predict an intense Q branch and weaker P, R, S, and O branches. Another consequence is that the liquid environment may induce molecular dipoles causing Raman selection rules to be operative that contribute further to an intensification of the Q branch. The bandwidth decreases gradually with temperature but undergoes no discernible discontinuous change on passing through the freezing point, which suggests that rotatory motion persists in the solid phase. The bandwidth of the fundamental of liquid and solid CD_4 is narrower than CH_4 but behaves in a similar fashion with temperature. The band shape and position of ν_3 of CD_4 in solution with CH_4 is indistinguishable from that of pure liquid CD_4, and suggests that resonance broadening or coupling of rotatory motion is not important for this phase. In the solid state, however, the ν_3 bandwidth of CD_4 in the CD_4-CH_4 solution is slightly larger than the ν_3 bandwidth of pure CD_4. (auth)

8402 DEUTERIUM ISOTOPE EFFECTS AS CRITERIA OF MECHANISMS IN THE HYDROLYSIS OF ORGANOPHOSPHORUS COMPOUNDS. D. Samuel (Weizmann Inst. of Science, Rehovoth, Israel). Vienna, International Atomic Energy Agency, 1963, Preprint SM-50/10, 18p. (CONF-269-10)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

The mechanisms of reactions of organophosphorus compounds in aqueous solution were studied by substitution of hydrogen by deuterium in either substrate or solvent. When the organophosphorus compound itself is deuterated, two types of effect can be distinguished: the primary isotope effects, in which a carbon to hydrogen bond is broken in the rate determining step, and secondary isotope effects, in which substitution in a position β to the reaction center changes the rate of reaction. By examining these effects on the rate of dephosphorylation, the rate determining step and hence the mechanism of reaction were elucidated. The effect of substitution of deuterium oxide for water as a solvent can also be used as a criterion of mechanism. Again, both primary and secondary deuterium solvent isotope effects can be distinguished. The effect of D_2O as solvent on the rates of hydrolysis of a variety of esters, substituted amides and mixed anhydrides of phosphoric acid was determined. Together with evidence from more extensive kinetic studies, the mechanism of reaction under various conditions was clarified. It was thus possible to distinguish the following types of reactions: unimolecular breakdown with C–O bond fission to form a carbonium ion and orthophosphate; unimolecular breakdown by a proton shift in the monoanion with P–O bond fission to form a "metaphosphate" intermediate; bimolecular displacement on phosphorus by water or other nucleophiles; and a preliminary protonation equilibrium in acid solution followed by breakdown to products. The possibility of extending these basic principles obtained with model compounds to more complicated phosphorus-containing systems is discussed. (auth)

8403 THE DEUTERATION OF TOLUENE AND TOLUENE-α,α,α-d_3. W. M. Lauer (Univ. of Minnesota, Minneapolis). Vienna, International Atomic Energy Agency, 1963, Preprint SM-50/31, 11p. (CONF-269-5)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

Toluene and α,α,α-d_3-toluene were deuterated in a mixture of deuterium oxide and trifluoroacetic acid. The partial rate factors for toluene found in earlier studies were $o_f = 250$, $m_f = 4$, $p_f = 420$. The α,α,α-d_3-toluene was prepared according to the method of Renaud and Leitch. Assay indicated 2.70 atoms of deuterium per molecule and the infrared spectrum showed no absorption peaks for ring deuterium. A comparison was made of the rates of deuteration of these two aromatic hydrocarbons. The secondary hydrogen isotope effect was found to be a very weak one; a result which is in agreement with the work of Swain, Knee, and Kresge on nitration, mercuration and bromination. Two different methods of study were used. In the first case the aromatic compound was dissolved in a deuterating agent consisting of deuterium oxide and trifluoroacetic acid and maintained at a temperature of 70°C for varying periods of time. Only a small amount of ring-deuterium was introduced during the time intervals adopted and the product was then examined for nuclear deuterium. An alkaline permanganate oxidation transformed the nuclear deuterated toluene and tri-α-deuterio-toluene samples to deuterium containing samples of benzoic acid. These benzoic samples were then analyzed for deuterium using a mass spectrometer to measure the 3 to 2 ratio of the H–D mixtures obtained by combustion, followed by a zinc reduction. Results indicated that the deuterium-containing benzoic acid resulting from the deuteration of α,α,α-d_3-toluene contains about 95% as much deuterium as the benzoic acid originating from toluene. However, the conclusion that this value represents the ratio of the rates of deuteration of these two hydrocarbons was subject to some reservation. Accordingly, a second method was studied. This procedure involved competitive deuteration of these two aromatic hydrocarbons using the deuterating mixture previously used and a mass spectrometric study of the deuteration product. The two hydrocarbons were analyzed separately and in a mixture of approximately equal proportions. This mixture was then deuterated for three hours and again studied in a mass spectrometer using in all cases low energy bombarding electrons in order to minimize fragmentation of the molecular ions. (auth)

8404 KINETIC DEUTERIUM-ISOTOPE EFFECTS IN ENZYMATIC FORMATE OXIDATION. H. Aebi (Universitat, Bern). Vienna, International Atomic Energy Agency, 1963, Preprint SM-50/8, 21p. (CONF-269-11)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

In order to study the role of substrate configuration in respect to enzyme activity and specificity two different enzymes were investigated: formico-dehydrogenase of plant origin (phaseolus) and catalase from liver tissue. In order to exclude any $C^{12}-C^{14}$-isotope-effect ordinary C^{14}-formate and fully deuterated C^{14}-formate, doubly-labeled intramolecularly, were used. Besides the determination of maximal rates of initial reaction velocity in presence of either substance, some problems related to the practical application of isotope effects in enzymology were investigated. Whereas the reaction rates of formico-dehydrogenase differed considerably ($k_H/k_D = 2.5$), the corresponding substrate constances were very similar ($K_{s(H)}/K_{s(D)} = 1.15$) at 27.5°C. This finding agreed with the observation that there is a linear correlation between reaction rate and the percentage of deuterated substrate present. Since there was a

difference in activation energy of 3000 cal/Mcl, the size of the isotope effect varied with temperature to some extent (16°C, 3.0; 37°C, 2.0). In coupled oxidation reactions of liver catalase, catalized by peroxidatic catalase activity, a similar isotope effect could be observed, provided that abundant H_2O_2 was generated and that excess formate was present in the system. For this purpose notatin (bacterial glucose-oxidase) and glucose were used. If the over-all reaction rate was limited by catalase activity, there was an isotope effect corresponding to a ratio of $k_H/k_D = 1.5$. If H_2O_2-production was the limiting factor, however, there was no isotope effect at all. Therefore, variation of the concentration ratio between notatin and catalase caused a steady increase or decrease in size of the isotope effect (1.0 to 1.5). On the other hand the presence or absence of such an isotope effect in more complex biological systems (homogenate, tissue slices, perfused organs, etc.) permitted a decision to what extent peroxidatic activity of catalase is the rate limiting factor in coupled oxidation processes, such as formate oxidation. This procedure was used in in vitro and in vivo experiments in order to decide whether catalase or H_2O_2-producing enzymes are rate limiting under given experimental conditions. If compared with the isotope effect observed in formate oxidation by alkaline permanganate ($k_H : k_D$ 6 to 10), those in enzymatic reactions are relatively small. (auth)

8405 CARBON-13 MAGNETIC RESONANCE. PART I. THE USE OF A PROTON DECOUPLER AND SAMPLE SPINNING FOR OBTAINING IMPROVED CARBON-13 MAGNETIC RESONANCE SPECTRA. PART II. CHEMICAL SHIFT DATA IN THE ALKANES. E. G. Paul and D. M. Grant (Univ. of Utah, Salt Lake City). 44p. (CONF-313-3)

From 2nd National Meeting of the Society for Applied Spectroscopy, San Diego, Calif., Oct. 1963.

The effects of various experimental quantities on the spectral features are analyzed, and optimum conditions for observing proton decoupled carbon-13 spectra are suggested. The spectra were observed in benzene, n-nonane, and n-decane. The carbon-13 chemical shift data are studied for the paraffin hydrocarbons. Results are presented for the linear alkanes, propane through decane, and the branched paraffins through the hexanes. (R.E.U.)

Radiation Chemistry and Radiochemistry

8406 (MITNE-41) IN-PILE LOOP IRRADIATION STUDIES OF ORGANIC COOLANT MATERIALS. Quarterly Progress Report, July 1–September 30, 1963. E. A. Mason and W. N. Bley (Massachusetts Inst. of Tech., Cambridge). Dec. 15, 1963. Contract AT(38-1)-334. 28p. (SRO-85)

Studies of organic reactor coolants for the heavy-water moderated, organic-cooled, reactor concept were begun. Santowax WR is being irradiated in the MITR In-Pile Loop. The Santowax WR was produced by benzene extraction of a Santowax OMP feed to reduce the para-terphenyl content from approximately 25 to 5%. This extraction produced a coolant feed material that has a melting range of 150 to 170°F instead of 180 to 320°F. An in-pile assembly was installed in a ten-plate fuel element and the irradiation of Santowax WR began on July 25, 1963. A dosimetry and calorimetry measurement was made in the fuel element prior to the start of the irradiation. The initial dose rate in the capsule located in the ten-plate element, averaged over the volume of the in-pile capsule, was 0.63 watt/gm. This dose rate represents a 23% increase in the dose over that from the former eight-plate element. The fast neutron contribution to the total dose increased from 37 to 44% in going from the eight- to the ten-plate element. A semi-batch irradiation was completed in three steps in which the OMP content in the coolant was reduced from 94 to 45 wt % (i.e., from 6 DP to 55 wt % DP) in the period from July 25, 1963 to September 26, 1963. The Santowax WR was distilled in laboratory glassware prior to charging to the loop so that the composition was essentially unchanged. Activation analyses, performed at the MITR, of the as-received and re-distilled Santowax WR indicated that the gross activity (primarily short lived Mn^{56} and Cl^{37}) was reduced by a factor of three by the distillation in glassware. The chlorine content of the distilled charge material was found to be 2 to 3 ppm. Comparison of the gross activation with para-terphenyl standard indicated that the Santowax WR being irradiated is as impurity-free as any other coolant previously irradiated at M.I.T. A preliminary $G^*(-\phi_3)$ value for the rate of Santowax WR disappearance during the transient period when the DP content increased from 22 to 55 wt % is $G^*(-\text{Santowax WR}) = 0.57 \pm 0.05$ molecules degraded per 100 ev absorbed. This value is not significantly different from the $G^*(-\text{Santowax OMP}) = 0.53 \pm 0.02$ molecules degraded/100 ev absorbed. Preliminary values of $G^*(-i)$ for each of the terphenyl isomers showed the relative stabilities to be para > meta > ortho. The preliminary values of $G^*(-i)$ for each of the isomers in the Santowax WR mixture, determined from the transient data, were not statistically different from those obtained for Santowax OMP. Experimental values of the heat transfer coefficient appeared to be approximately the same as those obtained with Santowax OMP under similar conditions. Twenty-five heat transfer data points from the transient period were analyzed on the computer. The data appeared to fit the general recommended correlation from the Santowax OMP irradiations: $Nu = 0.0079(Re)^{0.9}(Pr)^{0.4} \pm 10\%$. One fouling probe run of approximately 180 hr was completed during the transient run. Visual observation of the tube surface, which operated at 910 ± 5°F, indicated that the surface film is very thin. Quantitative evaluation of the deposition rate is in progress. (auth)

8407 (RAI-329) A STUDY OF THE MECHANISM OF RADIATION-INDUCED GELATION IN MONOMER-POLYMER MIXTURES. [Period Covered], May 1, 1961–October 31, 1963. Bruce S. Bernstein and George Odian (Radiation Applications Inc., Long Island City, N. Y.). Nov. 30, 1963. Contract AT(30-1)-2816. 98p.

Polyfunctional monomers such as allyl methacrylate, allyl acrylate, and diallyl maleate were found to greatly enhance the radiation crosslinking of many polymers. The radiation dose for incipient gelation of polyethylene is reduced by a factor of approximately 25; for polypropylene, the factor is 1500. Normally degradable polymers such as polyisobutylene and cellulose acetate were readily crosslinked at doses less than 1 Mrad. The ultimate scission/crosslinking ratio for polyethylene and polypropylene is unchanged by the presence of monomer, and the swelling behavior of the gels follows the Flory-Rehner equation. Physical properties of the monomer-crosslinked polyethylene were markedly improved over the straight crosslinked polymer. High temperature properties of all polymers were improved. Polyvinyl alcohol film exhibits enhanced crosslinking when irradiated in the presence of methanol/water/allyl methacrylate mixtures. Incipient gelation occurs at 0.06 Mrad for a typical 99% hydrolyzed

polyvinyl alcohol. 6,6 Nylon was crosslinked employing doses of 1–3 Mrads. A mechanism is discussed for the enhancement of polymer crosslinking via polyfunctional monomers. (auth)

8408 (TID-20006) STUDIES IN RADIATION CHEMISTRY AND CHEMICAL KINETICS. Final Technical Report, November 15, 1958 through September 15, 1963. (Illinois. Univ., Urbana). Dec. 15, 1963. Contract AT (11-1)-691. 19p.

Results of research in radiation chemistry and chemical kinetics are described. A computer program was written for Illiac to solve the diffusion kinetic equations for spherical spurs or axially homogeneous cylindrical tracks. It was used to study the radiation chemistry of dilute aqueous solutions. It was found that radicals initially present in the radiolysis of dilute aqueous solutions cannot have very different initial distribution parameters if the molecular products are assumed to come almost entirely from radical-radical reactions. A low-energy electron impact spectrometer was built to measure energies of optically forbidden electronic transitions in molecules by scattering of a monochromatic beam of electrons at 25 to 75 ev off a gaseous target and analyzing the energy of the electrons scattered at relatively large angles. Results showed that such forbidden transitions can be measured by this method. Molecular and free-radical processes in the thermal decomposition of n-C_4H_{10} were identified. An apparatus was designed to measure the energy dependence of bimolecular reaction cross sections in crossed molecular beams. Equipment was designed to study the energy dependence of the rate constant of the reaction $D + H_2 \rightarrow DH + H$ using monoenergetic D atoms. An apparatus was designed to study the elementary photochemical processes in n-butane. Calculations were made on the problem of intramolecular energy flow in a classical molecule. (M.C.G.)

8409 EFFECT OF IRRADIATION TEMPERATURE ON THE YIELD OF SOLUTE RADICALS IN FROZEN AQUEOUS SOLUTIONS. A. Pihl, T. Sanner, and T. Henriksen (Norsk Hydro's Inst. for Cancer Research, Montebello, Norway). Acta Chem. Scand., 17: 2124-5(1963).

The results of studies on the effects of the irradiation temperature on the efficiency of the indirect action of ionizing radiation are reported. Frozen aqueous solutions of DL-α-alanine were irradiated in vacuum with x rays at different temperatures in the range 77 to 195°K. In order to eliminate possible differences in the extent of the secondary reactions at the different temperatures used, all samples were heat-treated for 3 min after the exposure. The qualitative spectra observed immediately after the irradiation differed with the irradiation temperature. However, the spectra observed after the heat-treatment demonstrated that the same type of radicals were eventually present whether the irradiation was carried out at 77, 158, or 195°K. The quantitative results demonstrate that when alanine was irradiated in solution the observed number of solute radicals increased appreciably with increasing temperature. (P.C.H.)

8410 THE DECAY OF RADIATION-INDUCED FREE RADICALS IN EGG ALBUMIN AT DIFFERENT WATER CONTENTS. Goeran Loefroth (Universitetet, Stockholm). Acta Chem. Scand., 17: 2131-2(1963).

Egg albumin, originally containing 19% water, was equilibrated to different water contents by means of prolonged storage in atmospheres of controlled humidity. The samples were then irradiated with Co^{60} gamma rays during 1 hr to a dose of 0.43 Mrad. They were measured by electron spin resonance within 2 hr after irradiation and the decay of radicals followed an appropriate length of time. The results show that the production of radicals of egg albumin, and their decay, are strongly dependent on the water content. (P.C.H.)

8411 INTERMITTENT NEUTRON ACTIVATION BY "SQUARE WAVES" AND APPLICATION TO MEASUREMENT OF SHORT HALF LIVES IN THE INDUCED ACTIVITY. Elio Oliveri (Università, Palermo, Italy). Atti Accad. Sci., Lettere Arti Palermo, Pt. I, 22: 1-15 (1961-62) (Pub. 1963). (In Italian)

The intermittent neutron activation problem was examined, particularly when the neutron flux has a square wave shape. A method is shown that allows measurements of half lives of a few seconds in the induced activity. (auth)

8412 THE DECAY OF IRRADIATION DEFECTS IN DYED POLYMETHYL METHACRYLATE. I. D. Campbell and F. D. Looney (Commonwealth Scientific and Industrial Research Organization, Melbourne). Australian J. Chem., 16: 1141-4(Dec. 1963).

Electron spin resonance studies were made on polymethyl methacrylate (PMMA) dyed red. The behavior of the dyed PMMA to gamma irradiation and subsequent annealing followed in general outline that of undyed PMMA. However, the presence of the dye is evidenced by an additional line superposed on the usual ESR pattern. Also, the free-radical density induced in the substrate PMMA is similar in magnitude to that induced in clear PMMA. Thus the presence of the dye does not afford any radiation protection to the substrate and, from an ESR point of view, two separate free-radical systems exist side by side. (P.C.H.)

8413 GAMMA RAY EFFECTS ON TRIACETATE FIBER PROPERTIES. G. A. Klein, M. P. Tikhomolova, E. L. Aizenshtat, and M. Sultanova (Inst. of Physics and Tech., Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 2, 61-4(1963). (In Russian)

Studies of gamma radiation effects on cellulose triacetate fiber in nitrogen and air under various conditions of humidity showed that radiation resistance in air is much higher than in nitrogen. Resistance in dry air was higher than with 40 and 100% humidity. It was also shown that oil coating acts as a screening agent. (R.V.J.)

8414 AUTORADIOLYSIS OF 6,7,8,9,10,10-HEXACHLORO-1,5,5a,6,9,9a-HEXAHYDRO-6,9-METHANO-2,4,3-BENZODIOXATHIEPINE 3-OXIDE-5a,9a-C^{14}. Sylvan E. Forman and Jack R. Graham (FMC Corp., Central Research and Development Center, Princeton, N. J.). J. Org. Chem., 29: 233-5(Jan. 1964).

The autoradiolysis behavior of C^{14}-labeled samples of the insecticide Thiodan is reported. The spectra of radio-Thiodan showed the presence of Thiodan ether only after 2.5 years storage. Infrared spectral analysis indicated that the ratio of higher melting to lower melting Thiodan isomers in the radioactive samples increased from the ratio that was present shortly after preparation. The possible mechanism of autoradiolysis of Thiodan is discussed. (P.C.H.)

8415 γ-EXCITATION OF THE SINGLET AND TRIPLET STATES OF NAPHTHALENE IN SOLUTION. B. Brocklehurst, G. Porter, and J. M. Yates (Univ. of Sheffield, Eng.). J. Phys. Chem., 68: 203-5(Jan. 1963).

Studies were made on the gamma and ultraviolet radio-induced excitation of a deoxygenated 10^{-2} M solution of

naphthalene in MP (isopentane-methylcyclohexane) at 77°K. Both fluorescence and phosphorescence were observed during ultraviolet irradiation, gamma irradiation, and thermoluminescence experiments, but it was found that relative to ultraviolet excitation, phosphorescence was enhanced by gamma excitation and the enhancement was still greater in thermoluminescence. Approximate calculations of the excitation were made. The thermoluminescence was ascribed to naphthalene ion recombination. (P.C.H.)

8416 RADIATION SYNTHESIS OF IODONIUM COMPOUNDS. A. MacLachlan (E. I. du Pont de Nemours and Co., Wilmington, Del.). J. Phys. Chem., 68: 205-6(Jan. 1964).

Diphenyliodonium triiodide was formed when iodobenzene was irradiated with 2-6 Mev electrons. Studies were made on the mechanism of the formation. The effect of iodobenzene concentration was examined by irradiating 93% bromobenzene-7% iodobenzene, 99.2% bromobenzene-0.8% iodobenzene, and pure iodobenzene with the same radiation dose. At the higher iodobenzene concentration in bromobenzene, 0.7 g of product formed, while at the lower only 0.25 g could be isolated. Irradiation of pure iodobenzene yielded 0.75 g of diphenyliodonium iodide triiodide. (P.C.H.)

8417 PRODUCTION OF S^{35}-LABELED SODIUM THIOSULFATE AND POTASSIUM THIOCYANATE. M. Kucharski and R. Plejewski (Inst. of Nuclear Research, Warsaw). Kernenergie, 6: 649-50(Nov. 1963). (In German)

After a short review of the methods for S^{35}-labeled sodium thiosulfate and potassium thiocyanate, the method is described according to which these compounds are prepared in the Institute for Nuclear Research at Warsaw. (tr-auth)

8418 GAMMA-RAY INDUCED GRAFT COPOLYMERIZATION. VII. THE COMPOSITION OF CELLULOSE ACETATE-STYRENE GRAFTED FIBER. Kiyoshi Hayakawa and Kaoru Kawase (Government Industrial Research Inst., Nagoya, Japan). Kobunshi Kagaku, 20: 540-4(Sept. 1963). (In Japanese)

The compositions of two cellulose acetate fibers on which styrene was grafted, one being prepared by gamma-ray immersion technique at 25°C (IG) and the other by pre-irradiation technique at 65°C (PG), were investigated by the solvent extraction method. Components such as unreacted cellulose acetate, occluded polystyrene, and graft copolymer were separated from grafted fibers. Polystyrene occluded in IG(93.0% apparent grafting) amounted to 28%, but only 2% of fiber was found to be occluded polystyrene in PG (67.2% apparent grafting). Each occluded polystyrene had a slightly higher molecular weight than that produced in the liquid phase. Of the original cellulose acetate 83% was extracted from IG and 93% from PG as the unreacted parts, and their molecular weights did not seem to change during irradiation. The molecular weights of branched polystyrenes, obtained by hydrolysis of graft copolymers, were 4.0×10^5 in IG, and 1.7×10^6 in PG, higher than other component polystyrene respectively. (auth)

8419 GAMMA-RAY INDUCED GRAFT COPOLYMERIZATION. [VIII]. GRAFT COPOLYMERIZATION OF METHACRYLIC ACID ON SYNTHETIC FIBERS BY A PRE-IRRADIATION TECHNIQUE. Tatsuo Matsuda (Government Industrial Research Inst., Nagoya, Japan) and Naruo Maeda. Nagoya Kogyo Gijutsu Shikensho Hokoku, 12: 455-61(Sept. 1963). (In Japanese)

The gamma-ray induced graft copolymerization of methacrylic acid on synthetic fibers, such as nylon, acrylic, polyester, and polyethylene fibers, by a pre-irradiation technique in air was studied. The order of easiness of the grafting was as follows: nylon > acrylic > polyethylene > polyester. In nylon, the rate of grafting was observed to be proportional to 0.5 power of the dose, and it became higher with increasing polymerization temperature. The activation energy for the decomposition of peroxides was found to be about 20 kcal/mole. The amount of grafting on the irradiated fibers after storage at room temperature in air depended on the kinds of fibers. No decrease of the amount of grafting on nylon, but a considerable decrease on acrylic fiber was observed after storage. In nylon, when treated immediately after irradiation, the amount of grafting did not depend on the irradiation temperatures from −78°C to +30°C. In acrylic fiber it became larger with the decrease of the irradiation temperature. It was concluded that the formation of trapped radicals able to induce graft copolymerization is difficult in nylon and easy in acrylic fiber. The effect of the pH value in aqueous solution was studied. The rate of grafting was high at below pH 4, and lowered between pH 4 and pH 6, showing a minimum value at pH 7 and increasing again at pH 9. These results could be explained by the effect of pH value on the homopolymerization rate of methacrylic acid in aqueous solution. The mechanical and thermal properties of the grafted fibers were investigated, and it was found that the thermal properties of acrylic fiber were improved by the grafting. (auth)

8420 COLOR CENTRES IN SODIUM CYANAMIDE. M. J. Sole and A. D. Yoffe (Cambridge Univ., Eng.). Nature, 200: 1088-9(Dec. 14, 1963).

Irradiation of pellets of sodium cyanamide at room temperature with ultraviolet light from a high-pressure mercury lamp or with 2-Mev electrons resulted in the formation of a number of absorption bands. Results of electron spin resonance measurements indicated that the bands were due to color centers of the F-center type. It is postulated that they originate from photochemical decomposition. (C.H.)

8421 ANNEALING BY COMPRESSION FOLLOWING CHEMICAL RADIATION DAMAGE IN POTASSIUM BROMATE. T. Andersen (Univ. of Aarhus, Denmark). Nature, 200: 1094-5(Dec. 14, 1963).

Results of investigations on potassium bromate showed that chemical radiation damage was annealed by compression. Thermal annealing was also accelerated by compression. (C.H.)

8422 EFFECT OF GAMMA IRRADIATION ON THE DENSITY OF POTASSIUM CHLORIDE. Gregory Botsaris, Arthur Hill, Edward A. Mason, and Robert C. Reid (Massachusetts Inst. of Tech., Cambridge). Naturwissenschaften, 50: 709-10(1963). (In German)

It was established that by gamma irradiation of growing KCl crystals, a product was formed with an appreciably lower density than the reported value for melt crystals (1.984). The average density of the irradiated crystals was approximately 1.80 and not affected by dose or by whether the solution was stirred during irradiation. Similar controlled crystallizations without irradiation yield crystals with densities around 1.92. It was concluded that rapid diffusion-controlled crystallization will produce low-density KCl crystals containing appreciable voids filled with mother liquor. Irradiation is assumed to increase the rate of crystallization and/or lead to conditions favoring diffusion or mass-transfer control of the growth process. This results in higher void volumes and lower density crystals. (M.C.G.)

8423 RADIATION-SENSITIZED C_4-CYCLODIMERIZATION OF DIMETHYL MALEIC ACID ANHYDRIDE, INDENE, AND 1,2-DIHYDRONAPHTHALENE. C. H. Krauch, W. Metzner, and G. O. Schenck (Max-Planck-Institut für Kohlenforschung, Mulheim an der Ruhr, Ger.). Naturwissenschaften, 50: 710-11(1963). (In German)

The relay mechanism in the radioinduced sensitization of C_4-cyclodimerization is discussed. Studies were made of the reaction in dimethyl maleic acid anhydride, indene, and 1,2-dihydronaphthalene. G-values of 0.65 to 0.36, 0.44 to 1.72, and 0.81, respectively were obtained. (M.C.G.)

8424 ROLE OF HYDROGEN PEROXIDE IN THE RADIATION-INDUCED REDUCTION OF MERCURIC CHLORIDE. P. S. Rao (Banaras Hindu Univ., India). Naturwissenschaften, 50: 711-(1963).

The radioinduced reduction of mercuric chloride was found to be increased by the presence of H_2O_2. (M.C.G.)

8425 RADIOLYTIC INACTIVATION OF CHYMOTRYPSINOGEN BY ^{60}Co γ-RAYS. Masao Takisawa (Inst. of Physical and Chemical Research, Tokyo) and Jiro Matsuura. Nippon Kagaku Zasshi, 84: 514-19(June 1963). (In Japanese)

Co^{60} γ rays impinged upon a 0.01N sulfuric acid solution of chymotrypsinogen. Radiolytic inactivation was followed either by a polarographic method or by the spectrophotometric method. The radiolytic enzyme inactivation yield was found to be constant, i.e., $G_{inact} = 0.5$, and independent of the chymotrypsinogen concentration. However, G_{inact} seemed to increase with the protein concentration when it was measured by a change in polarographic wave. H, OH, and HO_2 radicals formed by the radiolysis of the water molecule may be exclusively involved in the inactivation of enzyme by the cleavage of bonds of rather small bond energy, e.g., hydrogen bond, and by the decomposition of some amino acid residues that may undergo bond fission with a minimum energy of activation. Stoichiometrically, the inactivation reaction may be regarded as the two-electron donating (or accepting) reactions of OH, H, and HO_2 radicals. The fact that the radiolytic enzyme inactivation yield was always 0.5 independent of the presence of air in solution indicates that an energy absorption of 2×100 ev renders 1 molecule of protein inactive. Therefore, only one tryptophane residue in one chymotrypsin molecule would be contributing to the enzymic activation. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8426 γ-IRRADIATED STARCHES AND AMYLOSE-ACRYLAMIDE GRAFTPOLYMERS AS AN ELECTROLYTE HOLDING MATERIAL OF DRY BATTERIES. Akira Mishina (Otani Women's Junior Coll., Japan) and Ziro Nikuni. Nippon Nogei Kagaku Kaishi, 37: 389-92(July 1963). (In Japanese)

Various new previously reported starch derivatives were examined to determine whether they are appropriate as an electrolyte-holding material of dry batteries. Samples used include non-irradiated potato starch, potato starch irradiated by 1×10^6 r and by 1.25×10^6 r γ rays, irradiated graftcopolymers (G-1 and G-2 fractions), and two other graftpolymers. An acid-proof property and anti-corrosive property against zinc chloride were examined by the measurement of swelling volume. At the same time, viscoelasticity of starch gel was also determined by a rheometer. Swelling volume measurement was made by a centrifugal precipitation method. γ-Irradiated amyloseacrylamide graftcopolymers showed satisfactory results. Particularly, the G-2 fraction of the γ-irradiated graftcopolymers was the best electrolyte-holding material. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8427 ON THE RADIOLUMINESCENCE OF ORGANIC SUBSTANCES. II. LUMINESCENCE DURATION IN NON-LUMINESCENT SOLVENTS. S. F. Kilin and I. M. Rozman. Opt. Spectry. (USSR) (English Transl.), 15: 266-9(Oct. 1963).

Luminescence intensity and duration were measured on water and alcohol solutions of certain compounds upon excitation with ultraviolet and ionizing radiation. It is shown that a specific quenching, causing a considerable reduction of the duration of luminescence, appears upon excitation with ionizing radiations. It was found that the rates of quenching by foreign substances (O_2 and CCl_4) and of concentration quenching are increased in radioluminescence. (auth)

8428 ABSORPTION AND EMISSION OF DIVALENT HOLMIUM AND ERBIUM IONS IN FLUORITE-TYPE CRYSTALS. Ya. E. Kariss and P. P. Feofilov. Opt. Spectry. (USSR) (English Transl.), 15: 308-9(Oct. 1963).

The absorption and emission spectra of CaF_2 and SrF_2 crystals activated by divalent ions of holmium and erbium are discussed. The luminescence was excited by the radiation of a mercury lamp. (C.E.S.)

8429 KINETICS OF DIMER FORMATION AND PHOTOHYDRATION IN ULTRAVIOLET-IRRADIATED POLYURIDYLIC ACID. P. A. Swenson and R. B. Setlow (Oak Ridge National Lab., Tenn.). Photochem. Photobiol., 2: 419-34(1963).

The decrease in absorbance at 2600 Å of poly-U following uv irradiation was analyzed quantitatively in terms of uracil-dimer formation and photohydration of uracil residues. At all wave lengths tested between 2300 and 2800 Å both dimer formation and hydration occur as well as dimer breakage. The cross section for uracil dimer breakage is large at 2300 and decreases to a relatively small value at 2800 Å. Consequently, at the shorter wave lengths the steady state for dimer formation and breakage is reached at lower doses than for the longer wave lengths. Absorbance decreases caused by longer wave lengths can be partially restored by irradiation with 2380 Å. At high doses, for all wave lengths, the main photoproducts are hydrated uracil residues. The maximum number of dimers that may be formed increases with wave length. The absorbance loss caused by photohydration may be reversed by acidification and heat. For 2650 Å irradiation, 95% of the absorbance is restored by a combination of the 2380 Å and thermal treatment. The values for the photochemical reactions of poly-U are fairly close to those for poly-T and for uridine. (auth)

8430 CAUSE OF THE OBSERVED POLARIZATION OF ELECTRON-INDUCED RADIATION FROM HELIUM. Robert H. McFarland (Univ. of California, Livermore). Phys. Rev., 133: A986-90(Feb. 17, 1964).

Recent improved measurements of threshold excitation and polarization of radiation from helium excited by electrons lead to the conclusion that previously reported anomalies are of experimental origin. Helium lines, $\lambda = 4922$, 4388, and 5016 Å, exhibit polarization energy dependencies similar to that previously reported for $\lambda = 3889$ Å. Helium lines $\lambda = 4922$ and 4388 Å have excitation probability energy dependencies through limited energy ranges as predicted by theory. A tentative explanation of earlier results involves the contribution to both the excitation probability and the polarization of radiation caused by radially directed

electrons elastically scattered from the electron beam. Attempts to reduce the radial travel of electrons resulted in threshold and near-threshold polarization measurements that approach expected magnitudes. (auth)

8431 EFFECT OF PLASTIC DEFORMATION ON THE PRODUCTION OF F CENTERS, M CENTERS, AND V CENTERS IN KCl. W. A. Sibley (Oak Ridge National Lab., Tenn.). Phys. Rev., 133: A1176-82(Feb. 17, 1964).

The effect of plastic deformation and heat treatment on the room temperature production of F centers, M centers, and V centers by Co^{60} gamma rays was investigated. Deformation of an irradiated sample caused a reappearance of the "first stage" coloration for F centers when the sample was irradiated further. This deformation induced enhancement of the colorability could be annealed out by heat treating the samples in air at 450°C for 20 min. It was also observed that the coloration curves for the V_2 band were very similar to those for the F band, and that they were affected by deformation, heat treatment, and optical bleaching in the same way. (auth)

8432 THE RADIOLYSIS OF PORPHYRIN METAL COMPLEXES. PART II. EFFECT OF GAMMA-RADIATION ON α, β, γ, δ-TETRAPHENYLPORPHINE AND ITS COPPER AND COBALT CHELATES. Chiroru Araki and Kiyoko Yamamoto (Inst. of Physical and Chemical Research, Tokyo). Rika Gaku Kenkyusho Hokoku, 39: 156-61(May 1963). (In Japanese)

Tetraphenylporphine (TPP) and its metal complexes, Cu–TPP and Co–TPP, were prepared. Dioxane solutions (10^{-4} M) of these compounds were irradiated by Co^{60} γ rays. When the irradiation was completed, the visible absorption spectra of the solutions were measured. TPP exhibited five characteristic absorption bands at 417, 515, 547.5, 591, and 648 mμ before irradiation. However, the γ irradiation caused a decrease in the absorbance of these bands, and a new band appeared at 653 mμ. A further irradiation resulted in decreasing the absorbance of this newly formed band, and finally all the bands in the visible region tended to disappear completely. The newly formed band at 653 mμ may be due to reduction of one of the pyrole nuclei in the porphine ring. Thus, it may be concluded that TPP is reduced to TPC under the irradiation of γ rays and finally the ring opening of TPC occurs. Cu–TPP and Co–TPP showed the same effect. The order of the ease of the ring opening follows TPP > Cu–TPP ~ Co–TPP. The bond between a metal and nitrogen would not be cleft before the ring opening. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8433 RADIOLYSIS OF ETHYLENEDIAMINETETRAACETATOCOBALTATE(III). Niro Matsuura (Tokyo Univ.), Nobuyoshi Shinohara, and Masao Takizawa. Sci. Papers Coll. Gen. Educ., Univ. Tokyo, 13: 179-90(Dec. 1963).

The radiolysis of Co(III)EDTA and EDTA in 0.8 N H_2SO_4 solution by gamma radiation was studied. The yields were determined spectrophotometrically. A decrease of EDTA with increasing gamma dose was found for the system of EDTA in 0.8 N H_2SO_4 with and without oxygen. By a debit amount of gamma energy absorption Co(II)EDTA is degraded into undetermined Co(II) chelate compound other than a simple aquo-ion or Co(II)EDTA. The observed yields all depend strongly on the scavenger concentration. (P.C.H.)

8434 RADIATION SYNTHESIS OF BORAZOLE POLYMERS. V. V. Korshak, N. I. Bekasova, Yu. G. Chikishev, V. A. Zamyatina, B. L. Tsetlin, and S. R. Rafikov (Inst. of Element-Organic Compounds, Academy of Sciences, USSR). Vysokomolekul. Soedin., 5: 1447-50(Oct. 1963).

Results are presented of an experimental investigation of the radioinduced polymerization of B-trimethylborazole, B-triphenylborazole, and B-triphenyl-N-trimethylborazole to produce polymers containing the borazole ring. Tabular data are given of the degree of conversion and the radiation yield for the various initial products and radiation conditions. One typical infrared absorption spectrum is included. The mixture of radiolysis products of B-trimethylborazole includes hydrogen, methane, and small amounts of ethane. (OTS)

8435 INVESTIGATION OF FREE RADICAL REACTIONS IN IRRADIATED POLYTETRAFLUOROETHYLENE. PART IV. Ya. S. Lebedev, Yu. D. Tsvetkov, and V. V. Voyevodskii (Inst. of Chemical Physics, Academy of Sciences, USSR and Inst. of Chemical Kinetics and Combustion, Academy of Sciences, USSR). Vysokomolekul. Soedin., 5: 1500-6(Oct. 1963).

A study was made of the reactions of fluoralkyl radicals with molecules in the gas phase. The electron paramagnetic resonance method was used to study the kinetics of the reaction of these radicals with NO and NO_2 molecules. The kinetics of the reversable reaction of fluoralkyl radicals with sulfur dioxide were studied to obtain approximate values for the bond energy of R-SO_2(5 kcal/mol) and the activation energies of the forward and reverse reactions (14 and 19 kcal/mol). A study was made of the loss of the radicals under the action of hydrogen and the light hydrocarbons (CH_4, C_2H_4, C_3H_8). It is shown that the radical attrition rate is proportional to the gas pressure over the polymer. The measured activation energies range from 0 to 10 kcal/mole. (OTS)

8436 THERMOOXIDATIVE DEGRADATION OF POLYPROPYLENE IRRADIATED WITH GAMMA RAYS. I. Benesh and G. Kaplan (Scientific Research Inst. of High Molecular Chemistry, Brno). Vysokomolekul. Soedin., 5: 1580-4(Oct. 1963).

An investigation was made of the effect of gamma radiation on the thermo-oxidative stability of polypropylene films having a phenolic antioxidant. It was found that the irradiation shortens the induction period of thermo-oxidative degradation due to radiation oxidation of both polymer and inhibitor with the polymer degradation being predominant. This is in agreement with the observed sharp reduction of tensile elongation of irradiated samples and the radiation chemical transformations of the pure inhibitor. (OTS)

8437 THE RADIATION CHEMISTRY OF ORGANIC COMPOUNDS. Joseph Frederick Merklin. Thesis, Minneapolis, Univ. of Minnesota, 1963. 93p.

Studies were made of the H_2 yields produced by γ irradiation of mixtures of benzene with cyclohexane, methylcyclohexane, ethylcyclohexane, and bicyclohexyl; mixtures of benzene with the arylcycloalkanes; and mixtures of methyl-, ethyl- and cyclohexane with their respective aryl derivatives. Both methyl- and ethylcyclohexane exhibit sharp reduction in their H_2 yields on addition of traces of benzene. The mechanism responsible for this effect seems to saturate at 0.05 M benzene and further addition of benzene reduces the H_2 yield. This is attributed to scavenging of thermal H atoms by benzene, and on the basis of this assumption kinetic analysis leads to thermal H atom yields of G(H) = 0.97 for methylcyclohexane (dose: 4.6×10^{21} ev/l) and G(H) = 1.7 for ethylcyclohexane (dose: 2.3×10^{21} ev/l). The "protection" efficiency at high benzene concentrations in both liquids is found to be the same as is exhibited by

benzene in cyclohexane mixtures at all benzene concentrations. The results suggest that thermal H atoms are not produced in the radiolysis of cyclohexane. A comparison of the dose dependence of $G(H_2)$ from methyl-, ethyl-, and cyclohexane is consistent with this interpretation. In bicyclohexyl, the dose dependence of $G(H_2)$ suggests that thermal H atoms are precursors of a significant fraction of the observed H_2 yield. Benzene, however, is found to be an inefficient scavenger in bicyclohexyl presumably because of the high reactivity of thermal H atoms with 2 tertiary C-H bonds in bicyclohexyl. For cycloalkane plus arylcycloalkane mixtures at high arylcycloalkane concentrations, the "protective" effect is qualitatively similar to that exhibited by benzene. However, at low concentrations, the arylcycloalkane is found to be somewhat less efficient than benzene in reducing $G(H_2)$ in methyl- and ethylcyclohexane. A comparison was made of $G(H_2)$ from the pure arylcycloalkane liquid with $G(H_2)$ from physical mixtures of benzene and the corresponding cycloalkane at an equivalent electron fraction. In all cases, the yield from the mixture was significantly higher than from the pure compounds. The yield of H_2 from arylcycloalkanes plus benzene mixtures was also studied and found to decrease linearly with increasing electron fraction of benzene. (Dissertation Abstr.)

8438 THE ELECTRODE BEHAVIOR OF SMOOTH PLATINUM IN SOLUTIONS CONTAINING PRODUCTS OF X-IRRADIATION. Kenneth Lewis. Thesis, New York, New York Univ., 1962. 125p.

An attempt to obtain further information on the previously discovered effects of x irradiation on the residual current flowing between 2 Pt electrodes in distilled water and acid solutions is reported. Studies were carried out of the capacitive and amperometric behavior of a cell in the presence and absence of x irradiation. Studies were also made of the potentiometric behavior of a cell with 2 identical Pt electrodes with H_2O_2 and with irradiated sulfuric acid solution added to 1 arm. The following conclusions were made: x irradiation does not produce important changes in the dielectric properties of ethanol or distilled water; radiation depolarization of the electrode surface does not markedly change the electrode surface state; small concentrations of surface active substances are either not adsorbed at the potentials used or lead to very low surface coverage; the magnitude and reproducibility of the residual current at Pt electrodes are dependent on oxide layers produced at the anode; the potentiometric behavior of wire electrodes maintained in a N atmosphere are dependent on the degree of removal of mechanical stresses by an annealing technique; the potential behavior of the wire electrode in the presence of hydrogen peroxide can be explained by the production of OH radicals by catalytic reaction of H_2O_2 at the electrode surface; and the radiation depolarization mechanism was further substantiated by the lack of identity between the effects of irradiated H_2SO_4 solution and H_2O_2 solutions on the Pt-wire electrode. (M.P.G.)

8439 ELECTRON SPIN RESONANCE STUDIES OF IRRADIATED BIOLOGICAL SULFUR COMPOUNDS. Joseph Howe Hadley, Jr. Thesis, Durham, N. C., Duke Univ., 1963. 115p.

The properties of the free radicals formed by γ-irradiation of single crystals of certain biological sulfur compounds were investigated. The crystals were irradiated at room temperature, and a K-band ESR spectrometer was employed to study the radicals at room temperature, 77°K, and 4.2°K. Quantitative studies of the g-tensor anisotropy and proton hyperfine splitting were carried out in single crystals of L-cystine dihydrochloride and N-acetyl methionine. The results on L-cystine dihydrochloride reveal that at 77°K and 4.2°K new radical orientations are observable in addition to those observed at 300°K. The study of N-acetyl methionine at 300°K at K-band shows that the doublet spectrum previously observed at X-band is resolvable into 2 doublets. This indicates that there are 2 radical orientations in the unit cell. When the crystal is cooled, the splitting between the 2 doublets increases. The results obtained for these 2 molecules are interpreted in terms of the radical structures. An effort was made to observe and measure the S^{33} hyperfine splitting of the above mentioned crystals and a single crystal of bis-dimethyl thiocarbamide disulfide. A spectrum believed to be due to S^{33} was observed in N-acetyl methionine. Approximate values of the hyperfine coupling constants were calculated on the basis of these data. The values obtained are in agreement, within the accuracy of the experiment, with the generally accepted assumption that the unpaired electron is in a p orbital on the sulfur atom. Lines were obtained for L-cystine dihydrochloride having some of the characteristics of S^{33} hyperfine structure, but differing to the extent that it was not possible to explain them. The S^{33} results obtained for bis-dimethyl thiocarbamide disulfide were inconclusive due to the incompleteness of the study of this molecule. (Dissertation Abstr.)

8440 PLUTONIUM FABRICATION PILOT PLANT EQUIPMENT (Engineering Materials). (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). (CAPE-1062)

This package contains 14 drawings. The equipment is used in plutonium chemistry and consists of a precipitator, drum filter, calciner, fluorinator, and glove box. (F.S.)

8441 IMPROVEMENTS IN OR RELATING TO REINFORCED RUBBER MANUFACTURE. Alphonse Lamm and Gusti Lamm (to Commissariat a l'Energie Atomique). British Patent 943,119. Nov. 27, 1963. Priority date Apr. 26, 1960, France.

A natural or synthetic rubber latex and the pulverulent reinforcing filler are subjected to ionizing radiation of 10^4 to 10^8 r, and the latex is then coagulated chemically or thermally. The filler material is in general carbon black and may be added to the latex as a suspension or aqueous dispersion. After irradiation, the aqueous dispersion of the elastomer and filler transformed into various shapes by coagulation. Examples are given of the mechanical properties after various treatments of the latex and filler. (R.E.U.)

Separation Processes and Procedures

8442 (ANL-6763) LABORATORY INVESTIGATIONS IN SUPPORT OF FLUID BED FLUORIDE VOLATILITY PROCESSES. PART IV. THE FLUID BED FLUORINATION OF U_3O_8. R. L. Jarry, A. V. Hariharan, G. Manevy, J. Fischer, J. J. Stockbar, J. G. Riha, T. D. Baker, and G. W. Redding (Argonne National Lab., Ill.). Oct. 1963. Contract W-31-109-eng-38. 24p.

In one of the processes under development, the uranium and plutonium content of a spent reactor fuel of the Dresden type would be fluorinated in a fluid-bed reactor to produce the volatile uranium and plutonium hexafluorides. The study of the fluorination of U_3O_8 was undertaken because it is the

major product obtained in an oxidative decladding step that is being proposed for the removal of uranium and plutonium from stainless steel-clad and Zircaloy-clad fuel elements. The study will also provide data needed for the development of apparatus and procedures for future work with mixtures of uranosic oxide and plutonium dioxide. Experiments were performed to determine the optimum reaction conditions for the conversion of U_3O_8 to uranium hexafluoride and for minimizing the elutriation of unreacted U_3O_8 from the fluid bed. Elutriation of U_3O_8 from the fluid bed was minimized when a fluid bed height of 8 in. of 120 mesh alumina, a fluorinating gas phase containing 20 vol % fluorine, and a reaction temperature of 500°C were employed. Conversion of greater than 99% of the U_3O_8 to uranium hexafluoride was obtained when the feeding-fluorination period, in which the U_3O_8 powder was fed into the fluid bed and the major part of the fluorination was accomplished by reacting the oxide with 20 vol % fluorine, was followed by a recycle-fluorination period of 5 hr at 500°C with 100% fluorine. Kinetic data for the fluorination of U_3O_8, obtained by means of a thermobalance, are reported for the temperature range from 300 to 400°C. The data were treated by the diminishing-sphere model. Experimental results are also presented for the oxidative decladding of stainless steel-clad and Zircaloy-clad uranium dioxide pellets. (auth)

8443 (DP-841) PERFORMANCE OF A MULTISTAGE CENTRIFUGAL CONTACTOR. Albert A. Kishbaugh (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Oct. 1963. Contract AT(07-2)-1. 27p.

A five-stage centrifugal contactor with 10-inch-diameter stages processed natural or enriched uranium solutions by solvent extraction. High mass transfer efficiencies for uranium were attained at total flow rates of at least 40 and 60 gpm, respectively. The unit had a hydraulic capacity in excess of 60 gpm with undiluted tri-n-butyl phosphate as the solvent, provided the aqueous phase contained at least 3M HNO_3. (auth)

8444 (GAT-P-30) ELECTROLYTIC REMOVAL OF DISSOLVED COPPER FROM ACID CLEANING SOLUTIONS. M. L. Geneva (Goodyear Atomic Corp., Piketon, Ohio). Dec. 31, 1963. Contract AT(33-2)-1. 13p.

A process based on the electrowinning method has been developed to electrolytically remove dissolved copper from an acid cleaning solution. Carbon anodes and steel cathodes were tested for possible use as electrode materials; they deteriorated very quickly under the operating conditions and were therefore rejected. Lead anodes and copper cathodes showed no deterioration in the tests, and were chosen for use as electrodes in this process. Power was provided by a d-c generator operating continuously at 200 amps and 3 to 5 volts. The cost of electricity at this operating level is only about $3.00 per month. (auth)

8445 (HW-78388(p.4.1-15)) CHEMICAL RESEARCH AND DEVELOPMENT. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Preparations for the experimental remote reprocessing of irradiated Plutonium Recycle Test Reactor fuel assemblies were continued. A 30-lb-capacity UO_2 oxidizer designed for remote operation was successfully tested in cold runs. Crushed and sized electrolytic UO_2 in −8 to +10 mesh size contained occluded salts that could not be removed by aqueous washing. A low-temperature (−100°C) liquefaction process was used to remove chlorine from an air-Cl_2 mixture. The process is to be applied to removal of chlorine- and I^{131}-laden off gas from salt-cycle-processed fuel elements. Salt cycle flowsheet studies showed that a plutonium enrichment factor of 40 can be achieved in the equimolal LiCl–KCl system. Corrected values of ΔS and ΔH are reported for the reaction $UO_2 + Cl_2 \rightarrow UO_2Cl_2$ in chloride melts. Spectrophotometric studies of reactions involving plutonyl species in chloride melts were continued. In calcination of full-level Purex 1WW, the addition of calcium nitrate to high-sulfate waste reduced sulfate carryover to the condensate to less than 0.05%. Simulated Purex 1WW waste neutralized with ammonia, calcined, and treated with 0.72M $NaHSO_4$ yielded a meltable product. The cold semi-works radiant-heat spray calciner was altered so that all solids are received in a single pot and off-gases are filtered through porous metal elements. The ability of this calciner to make a product, which could be subsequently melted to produce a phosphate glass was evaluated. In preliminary runs a true glass structure was not produced. The electrostatic bubble scrubber was completed except for measurements of the particle deposition pattern. Instrumentation is being developed for measurement and control of powder and melt levels in waste calciner product canisters. Linde 13X was found to be cerium-selective in the presence of cesium and sodium. Dowex-1 was found to be superior to other resins for ruthenium removal from Purex acid recovery condensate. (M.C.G.)

8446 (NBL-206) BORON SCRAP RECOVERY BY PYROHYDROLYSIS. A. R. Eberle, L. J. Pinto, and M. W. Lerner (New Brunswick Lab., AEC, N. J.). Jan. 1964. 10p.

A pyrohydrolysis procedure is being tested for the recovery of boron-10 from scrap boron-10 materials. Steam at 950°C is led into a nickel reaction tube and passed over the sample held in nickel trays. The boric acid in the condensate is converted to potassium fluoborate by treatment with potassium hydroxide and hydrofluoric acid. Scrap consisting chiefly of boron carbide and the ash from boron-impregnated tape have been pyrohydrolyzed successfully. The product assays greater than 98% potassium fluoborate. (auth)

8447 (EURAEC-708) DISSOLUTION OF PLUTONIUM DIOXIDE IN MIXTURES OF NITRIC AND HYDROFLUORIC ACID. Special Report No. 11. (Brussels. Centre d'Étude de l'Énergie Nucléaire and Société Belge pour l'Industrie Nucléaire, Brussels). [1962]. Work Performed under United States–Euratom Joint Research and Development Program. 24p. (A Translation of BN-6212-03)

A study was made of the influence of different factors such as mechanical stirring, nitric and hydrofluoric acid concentrations, temperature, and presence of impurities on the dissolution rate of plutonium oxide of low reactivity in a nitric acid–hydrofluoric acid medium. The activation energy of the reaction was calculated (~15 kcal $mole^{-1}$) and the different complexes present during the reaction and after dissolution are identified. A hypothesis concerning the mechanism of dissolution is proposed. Finally, the routine conditions for dissolution are established. (auth)

8448 PREPARATION OF THE RADIOACTIVE Be^7 ISOTOPE FROM CYCLOTRON TARGETS. I. F. Kolosova and I. V. Kolosov. At. Energ. (USSR), 15: 422-3(Nov. 1963). (In Russian)

While separation of Be^7 formed in Li cyclotron targets by thenoyl trifluoroacetone gives good results, it presents difficulties in the re-extraction of Be from the organic phase and in its separation from Fe. Therefore, the method involving the nonisomorphous coprecipitation of Be^7 with NH_4OH (H. Heymond et al, J. Chem. Phys. 18, 1685 (1950)) without carrier, on Fe hydroxide was re-examined. Tar-

gets consisting of metallic Li or of a mixture of Li oxides and carbonates in W foil were irradiated for 18 hours with 12-Mev neutrons and for 6 hours with 13.4-Mev neutrons, respectively. After keeping the targets for 1 month, the first one was treated with water, the second with dilute HCl, and the treatment was finished in both cases with concentrated HCl. The Be^7 content was determined by the γ activity of the preparation, which also contained very small amounts of Zn^{65}, Fe^{55}, and Fe^{59}. The Be^7 was separated on the Fe hydroxide, precipitated by carbonate-free NH_4OH. The deposit, containing all the Be^7, was then dissolved in HCl, after which KCNS was added to the solution. The Fe was extracted 8 times with isopropyl ether. The Be^7 remained in the aqueous phase, which also contained small amounts of W, subsequently eliminated. In case of irradiation of the natural isotopic mixture of Li_2O with 13.4-Mev neutrons, the Be^7 yield was found to be (1.2 ± 0.2) $\mu C/\mu amp \cdot hour$. (TTT)

8449 SEPARATION AND PURIFICATION OF RARE EARTH ELEMENTS BY FRACTIONAL CRYSTALLIZATION. III. SEPARATION OF CERIUM GROUP ELEMENTS BY FRACTIONAL CRYSTALLIZATION OF DOUBLE MAGNESIUM NITRATE. Jiro Shiokawa (Osaka Univ.). Kogyo Kagaku Zasshi, 66: 762-5(June 1963). (In Japanese)

The separation of cerium-group elements was carried out by the fractional crystallization of double magnesium nitrate. The composition of the rare earth salt used in this experiment was as follows: La_2O_3, 23.4%; CeO_2, 1.2%; Pr_6O_{11}, 13.1%; Nd_2O_3, 57.5%; Sm_2O_3, 3.1%; and $\Sigma[Y_2O_3]$, 1.7%. During the fractional crystallization the degrees of separation of cerium group elements were known from the behaviors of Pr and Nd, which were analyzed by spectrophotometry. When the fractional crystallizations were carried out 500 times with about 60 fractions, the pure oxides of La and Nd were obtained, and the concentrated oxides of Pr and Sm were separated. The pure oxides obtained were 1.0 kg of La_2O_3 and 1.5 kg of Nd_2O_3. (auth)

8450 SEPARATION AND PURIFICATION OF RARE EARTH ELEMENTS BY FRACTIONAL CRYSTALLIZATION. IV. PURIFICATIONS OF CERIUM GROUP ELEMENTS BY FRACTIONAL CRYSTALLIZATIONS OF DOUBLE SALTS OF NITRATES. Jiro Shiokawa (Osaka Univ.). Kogyo Kagaku Zasshi, 66: 765-9(June 1963). (In Japanese)

By fractional crystallizations of double salts of nitrates, binary mixtures of cerium-group elements were purified. The samples of binary mixtures used in these experiments were obtained by the fractional crystallization of double magnesium nitrate. In the purification of La and Pr from La–Pr mixture, the fractional crystallization of double ammonium nitrate was carried out using 10% HNO_3 solution. Ce was added as the separating element. The fractional crystallization of double manganese nitrate was used for the purification of Nd from Pr–Nd mixture. In this case, concentrated HNO_3 solution was chosen as the solvent. Sm was purified from Sm–Σ[Y] mixture by fractional crystallization of double bismuth nitrate, using 30% HNO_3 solution. Pure oxides of La, Pr, Nd, and Sm were obtained. The conditions of separation of cerium-group elements were known from the behavior of elements, and distribution charts of elements were obtained during the process of each fractional crystallization. (auth)

8451 DEVELOPMENT OF A PRODUCTION PROCESS FOR RADIO-KRYPTON RECOVERY BY FRACTIONAL ABSORPTION. R. F. Taylor and G. P. Wall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 307-46(1963).

A description of the arisings of fission product krypton in gaseous effluents from the treatment of irradiated fuels is followed by a review of the principal methods of krypton recovery, based on adsorption on charcoal beds, low-temperature liquefaction and distillation, and absorption in various liquid solvents, together with grounds for choosing the McIlroy solvent absorption process for eliminating the bulk diluent gases. The separate adsorption process on charcoal beds that would be used for final enrichment of krypton is not discussed. The nature of gas feeds is discussed with emphasis on the types of impurity likely to be present and the pretreatment thereby entailed. The development of the selected processing scheme for the large-scale recovery of krypton from dilute feeds is presented. The problems and techniques of dealing with the recycling of carbon tetrachloride solvent of the absorber system are treated separately. The central features of the process design, the analysis and prediction of absorption behavior are discussed. A pilot plant was operated to extend the experimental data of McIlroy to large-scale plant working at high flow velocities, to longer columns of higher contacting efficiency, and to gas feeds of a variety of compositions. The plant and experimental techniques used are described and the experimental results are presented and analyzed in terms of stage computations. The assumption of McIlroy's computation method that all components have the same height is shown to be not a reasonable one. The consequent errors in predicted krypton concentrations are not necessarily excessive but the corresponding concentrations for other components are often seriously in error and unacceptable for design purposes. Simple empirical modifications are introduced so that computation proceeds in terms of krypton stages that can be associated with definite locations in a column. At these stages, or any intermediate level, the correct concentrations of the other components are obtained by interpolations based on the experimental data given herein. The design of absorber columns is outlined. Scale-up effects and pressure drops are discussed and calculations are given of column lengths required for typical separation duties. The main features of the process design based on the pilot plant work are followed by application of the analysis of the experimental data to bring out important points of production plant operation. The scope of the design and cost estimating study and observations made on some factors influencing recovery costs are described. (auth)

8452 REACTOR FUEL PROCESSING. Volume 6, No. 4. Stephen Lawroski, ed. (Argonne National Lab., Ill.). 1963. $0.55(GPO) (domestic), $0.70(GPO) (Foreign). (One of the Technical Progress Reviews prepared quarterly for the Division of Technical Information, USAEC).

Developments in reactor fuel processing are reviewed. Topics covered include: commercial aspects of fuel processing; research and development on aqueous processing; research and development on nonaqueous processing; waste disposal; and production of uranium, thorium, plutonium, and their compounds. Separate abstracts were prepared for each topic. (M.C.G.)

For abstracts of individual sections see: 8375, 8453, 8454, 8455, and 9744.

8453 COMMERCIAL ASPECTS OF FUEL PROCESSING. Reactor Fuel Process., 6: No. 4, 1-6(1963).

Domestic and foreign fuel-processing plans are discussed. A permit was granted by the AEC for construction of a plant to process irradiated fuel. Commercial prices for

refined UF_6, financing privately owned fuel inventories, costs of processing irradiated fuel from fast reactors, and costs for salt-cycle type, close-coupled fuel processing were investigated. Because of the establishment of land burial sites by private industry, the AEC withdrew from its program for disposition of solid low-level radioactive wastes. (11 references) (M.C.G.)

8454 RESEARCH AND DEVELOPMENT ON AQUEOUS PROCESSING. Reactor Fuel Process., 6: No. 4, 7-14(1963).

Preparation of fuel for processing by mechanical pretreatment, dissolution of fuel cores, and total dissolution of metallic materials is described. Developments in solvent-extraction and ion-exchange processes are discussed. Designs of processing plants, slurry pumps, solvent-extraction contactors, and electrolytic dissolvers are described. Corrosion in the Sulfex and Zirflex processes, corrosion of construction materials for the ORNL transuranium-element processing facility and for the electrolytic-dissolution process facility, and corrosion of stainless steel in nitric acid containing dissolved chromium are discussed. (28 references) (M.C.G.)

8455 RESEARCH AND DEVELOPMENT ON NONAQUEOUS PROCESSING. Reactor Fuel Process., 6: No. 4, 15-38(1963).

Developments in liquid-phase, dry-halogenation, direct-fluorination, and fused-salt volatility processes are described. Pyrometallurgical processes for EBR-II fuels are discussed. Iodine behavior in melt-refining processes is described. Liquid-metal and salt processes, being developed for purification of reactor fuel materials, are outlined. Results of tests of materials for use in plutonium, mercury, bismuth, or alkali-metal systems are given. Nonaqueous methods for processing oxide and carbide fuels are described. (65 references) (M.C.G.)

8456 INDUCTION ZONE MELTING OF THE RARE REFRACTORY METALS. O. P. Kolchin, I. K. Berlin, and N. V. Presnetsova. Tsvetn. Metal., No. 9, 59-65(Sept. 1963). (In Russian)

Samples of titanium, zirconium, and vanadium were subjected to zone melting by induction heating in an atmosphere of argon (1 atm), or in a vacuum of 1×10^{-3} mm Hg std within a quartz tube. The metal column was 11 mm in diameter and 85 mm long. The rate of zone movement was 2 mm/minute. The analytical results showed that considerable purification of these high-melting refractory metals occurs as a result of impurity volatilization. The impurities do not accumulate at the ends of the sample. The titanium was melted in an argon atmosphere, because considerable volatilization of Ti was observed at a vacuum of 8×10^{-2} mm Hg std. Fe, Mg, Mn, Cr, Si, Al, and V were separated from Ti by volatilization. The carbon content in Ti did not change after 11 zonal meltings. Nitrogen decreased by an order of magnitude, and sulfur was completely eliminated from Ti. Zirconium was zone-melted in argon. After 8 passes, the zirconium was spectroscopically pure with respect to Mn, Si, Ni, Mo, Ti, Cu, and Mg. Vanadium was purified from Mg, Ti, Mo, Cu, Fe, Al, and Si impurities by zone melting after 4 passes. Impurity analyses are given for each pass. (TTT)

8457 THE BEHAVIOR OF HAFNIUM DURING THE ELECTROLYTIC PREPARATION OF ZIRCONIUM FROM A CHLORIDE-FLUORIDE FUSED SALT MELT. L. E. Ivanovskii and O. S. Petenev. Tsvetn. Metal., No. 9, 65-9 (Sept. 1963). (In Russian)

An equimolecular mixture of NaCl and KCl was placed in an electrolyzer, and then, potassium fluorozirconate containing 32.9 wt % Zr, 1.4 wt % Hf, and 41.8 wt % F was added to the vessel. The effect of fluoride ion, temperature, current density, and concentration of fluorozirconate in the bath on the separation of Zr and Hf was determined. Increasing the fluoride concentration in the bath from 12 to 19 wt % (from 6 to 13 g-ion F/g-ion Zr) led to an increase of Hf in Zr by a factor of 2. Hence, electrolysis in a chloride bath would lead to better separation of Zr and Hf. The content of Hf in the Zr metal decreased from 0.47 wt % to 0.23 wt % on increasing the Zr concentration in the bath from 6 to 15 wt %. The amount of Hf in the Zr metal decreased from 0.35 to 0.12 wt % on decreasing the cathode current density from 4.0 to 0.2 amps/cm^2. The content of Hf in the Zr metal decreased with increasing temperature. Complex double salts of Zr covered the surface of the Zr metal, and prevented further separation of Zr from Hf. (TTT)

8458 ON EXTRACTION CHEMISTRY OF SOME CHLORORUTHENIUM COMPLEXES FROM AQUEOUS HYDROCHLORIC ACID SOLUTIONS. E. Hallaba, Reda A. I. Azzam, and M. Anissa (Atomic Energy Establishment, Cairo). Z. Anorg. Allgem. Chem., 324: 233-40(Oct. 1963).

Carrier-free nitrosyl radioruthenium trichloride and radioruthenium hydroxytrichloride were prepared. Solvent extraction studies of both compounds in HCl and NaCl aqueous solutions lead to the conclusion that a change in the Ru-valence state from II to IV decreased the extractability of the element by tri-n-butyl phosphate (TNP) seriously. A probably interpretation is stated. It was also shown that the extracting power of TBP increases with dehydration and decreases with acidolysis by HCl aqueous solutions. Data are represented and discussed. (auth)

8459 TRACER STUDIES ON THE EXTRACTION OF METAL IONS. IV. EXTRACTION OF THORIUM, PROTACTINIUM AND URANIUM BY β-PHENOXYETHYLAMINES AND SEPARATION OF URANIUM FROM RARE-EARTH ELEMENTS. Ignacy Stroński and Jan Szymakowski (Inst. of Nuclear Physics, Krakow). Z. Physik. Chem. (Frankfurt), 39: 10-19(Oct. 1963).

The influence of hydrogen ion concentration on the extraction of chlorides and nitrates of Pa^{5+}, Th^{4+}, and U^{6+} by means of β-phenoxyethylamine and 2-methyl-β-phenoxyethylamine was studied for the systems: water-benzaldehyde and water-o-chlorobenzaldehyde. Uranium was separated from terbium and thulium by means of 2-methyl-β-phenoxyethylamine. Tracer studies were made to determine separation efficiencies. (M.C.G.)

8460 SORPTION OF DILUTE SOLUTIONS OF URANIUM BY PEAT. Tadeusz Adamski, Kazimierz Majchrzak, and Jozef Panas (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). 15p. (CONF-207-11). (In Polish)

From Second Yugoslavian Polish Symposium on Uranium Technology and Metallurgy, Zakopane, Poland, Sept. 1963.

The possibility of utilizing peat for uranium sorption from solutions of 1 gm/liter and 1 mg/liter were investigated. It was found that the exchange ability of peat depends on the pH of the solution and on the complexity of uranyl cation. Maximum sorption lies in the region of pH = 4 to 5. Ions that are highly complex decrease the exchange ability of peat. Using a 1 mg/liter solution of U in mining water, brought to a pH of 4.5 with sulfuric acid, the passage of this solution through peat reduced the uranium concentration to less than 0.01 mg/liter. (TTT)

ENGINEERING

General

8461 (BRL-Memo-1520) THE ELASTIC RESPONSE OF THIN SPHERICAL SHELLS TO INTERNAL BLAST FROM ECCENTRICALLY PLACED EXPLOSIVE CHARGES. Wilfred E. Baker (Ballistic Research Labs., Aberdeen Proving Ground, Md.). Nov. 1963. 28p.

A theory of elastic response of a thin spherical shell to the axisymmetric blast loading obtained by detonation of eccentrically placed explosive charges within the shell is presented. Some measurements of response of a small steel shell are also reported. No comparison is made between theory and experiment, because of difficulties encountered in computation from the theory. Simplifications which may allow computation and additional experiments are suggested. (auth)

8462 (LA-2901) PRESTRESSED CONCRETE SPHERICAL CONTAINMENT VESSEL. D. W. Mueller and A. P. Furnish (Los Alamos Scientific Lab., N. Mex.). May 1, 1963. Contract W-7405-eng-36. 64p.

A description is given of a 20-foot-OD, 16-foot-ID spherical concrete shell, prestressed, with an outer steel skin, which was designed to serve as a container for explosions. This 20-foot containment vessel, which has not been built, is described in Part I. Design specifications and reproductions of the original engineering drawings are also given. Part II describes a quarter-scale model of the vessel, which was built and tested to destruction with high explosives. Results of the tests are described, and details are given. (auth)

8463 (TID-4101) ENGINEERING MATERIALS LIST CUMULATIVE DRAWING NUMBER INDEX THROUGH SUPPLEMENT 18. Richard E. C. Duthie, ed. (Division of Technical Information Extension, AEC). Jan. 1964. 148p.

A cumulative index is presented of all numbers assigned to engineering drawings and specifications that have been announced in the Engineering Materials List (EML) (TID-4100) and Supplements 1 through 18. This index completely supersedes the Drawing Number Index issued previously in EML Index 2, dated July 1962. (auth)

8464 (TID-19924) BASIC STUDIES IN GAS-SOLID SUSPENSION. Quarterly Report No. 62-2, May–July 1962. Richard L. Peskin (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). Sept. 1, 1962. Contract AT(30-1)-2930. 9p.

A basic theoretical and experimental study of fluid mechanics in a turbulent gas-solid suspension is being made. The theoretical work is on the probability of encounter theory for the basic equations of motion and investigation of the basic mechanisms of thermal plate-out. Higher order terms for solid particle diffusivity are computed using the probability of encounter theory. The result of these computations is that the theoretical diffusivity of the small particles compares more favorably with the available experimental data better than that of the first order theory. The equations for particle intensity and velocity correlation and relative motion dissipation are set up. The theory of radiometer forces is investigated and its relation to thermal plate-out is considered. The radiometer force is of principal importance in forcing small particles to diffuse to a cold wall in a temperature gradient. However, this radiometer force is only present if the particle size and the gas conditions are such that slip flow exists over the particle surface. Since particles of diameter of one-tenth to five microns are, for pressures of one atmosphere and temperatures above 60°F, in the slip-flow regime if the suspending gas is air, or in the free molecule-flow regime if the suspending gas is helium, they are readily subject to radiometer type forces. One possible solution to the plate-out problem may be to use a different suspending gas with smaller mean free path, or to operate at increased pressures so that the suspension is not in the slip-flow regime. Work on the experimental program is concentrated on the procurement, design, and assembly of the major test loop and of associated instrumentation. Construction of the fiber optic probe and its associated calibration jigs is continuing, and an investigation into the applicability of hot film anemometry for the measurement of statistical quantities in gas is being undertaken. (auth)

8465 (TID-19925) BASIC STUDIES IN GAS-SOLID SUSPENSION. Quarterly Report No. 62-1, February–April 1962. (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). June 1, 1962. Contract AT(30-1)-2930. 12p.

A basic theoretical and experimental study of fluid mechanics in a turbulent gas-solid suspension is being made. The probability encounter theory for the basic equations of motion is coupled with classical theories of the structure of turbulent shear flow in an attempt to put the existence of the radially outward drift velocity of particles on a firm basis. The result of these two theories taken together is that there exists a net outward diffusion from the center axis of turbulent channel flow. This outward diffusion leads to a non-uniform density distribution of particles. The resultant concentration is higher near the wall than in the center of flow. This concentration effect is more pronounced for small particles than it is for the larger particles. In applications where large temperature gradients are encountered with temperature decreasing toward the wall the diffusion mechanism is probably responsible for bringing the small particles from the center of the flow to the vicinity of the wall where large temperature gradients are present. These large temperature gradients would then be the main driving mechanism responsible for a non-uniform molecular diffusion which would carry the particle to the wall proper. Thus it may be concluded from this theory that plate-out phenomenon favors small particles not only because they are more mobile under the action of thermomolecular diffusion but because they tend to diffuse from the turbulent core to the boundary layer regions of high temperature gradient more readily than due to the large particles. The diffusion section, the approach duct, and the experimental duct are 90% complete for the basic flow apparatus. A design for the primary cyclone separator is nearly complete. The helium diffusion apparatus for the determination of turbulent scale and intensity is completed and operates satisfactorily. Samples of fiber optics are compared microscopically with the glass beads. The fiber optic is 80 microns in diameter and this corresponds to the largest glass bead. The smallest glass bead used is 20 microns in diameter. The fiber optic system can be made small enough to be used as a density probe and a velocity probe. A small scale two-phase flow loop is being constructed for use as a visual demonstrator and for opti-

cal and radio tracer experiments. General instrumentation for pressure and temperature measurement is being installed as the assembly of the experimental duct proceeds. (auth)

8466 (TID-19963) BASIC STUDIES IN GAS-SOLID SUSPENSION. Quarterly Report No. 63-2, April–September 1963. (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). Oct. 25, 1963. Contract AT(30-1)-2930. 30p.

Research results of the study of the fluid mechanics of suspensions, in particular, the results for the helium diffusion study, solids density and velocity profiles studies, solid particle velocity slip studies, and fluid velocity profiles are discussed. Mention is made of several problems concerning electrostatic effects in gas-solid suspensions and pulsating flow problems. The planned program in heat transfer is discussed. (N.W.R.)

Facilities and Equipment

Refer also to abstracts 9574 and 9728.

8467 (ORNL-3546) PRESTRESSING A TWO-LAYER PRESSURE VESSEL BY CONTROLLED YIELDING OF THE INNER LAYER. R. W. Schneider (Oak Ridge National Lab., Tenn.). Jan. 29, 1964. Contract W-7405-eng-26. 30p.

A method is presented for designing a two-layer pressure vessel wherein contact between the layers is produced by controlled yielding of the inner vessel by internal pressure. The amount of prestress depends upon the dimensions of the vessel, the properties of the material of construction, and the prestressing pressure. The method takes into account the actual stress-strain curve of the material and satisfies the rules of plastic flow with work hardening. (auth)

8468 DANGER—RADIOACTIVE. VIEWING WINDOWS IN LABORATORY HOT CELLS PROVIDE A SAFETY FACTOR AND STILL PERMIT VISIBLE ACCESS TO THE OPERATION. Tharold E. Northup (Oak Ridge National Lab., Tenn.). Lab. Management: 19-22(Sept.-Oct. 1963).

The quality and types of windows used for shielding and viewing in hot cells are discussed. Types of windows used for various radiations are listed. Window terminology is graphically illustrated. (P.C.H.)

8469 IMPROVEMENTS IN OR RELATING TO THE EFFECTING OF ENTRAINMENT OF PARTICULATE SOLID IN A GAS STREAM. James Elgie Lloyd and Joseph Raymond Mullarkey (to United Kingdom Atomic Energy Authority). British Patent 940,215. Oct. 30, 1963. Filed Nov. 13, 1959.

An apparatus for drawing particles into a transporting gas stream is patented. The apparatus may be used for transporting a particulate solid between stages and to final storage in the production of UF_4 by a process using fluidized beds. The apparatus consists of a container with an inverted conical lower section. An inlet for the fluidizing gas is at the apex of the lower section, and an outlet pipe extends out of the container at the top, with its lower end under the level of the fluidized bed of particulate solid in the container. The container also has an inlet for the particulate solid and a gas inlet above the level of the fluidized bed. (M.P.G.)

8470 IMPROVEMENTS IN OR RELATING TO HEAT EXCHANGERS. Eric John Forster (to Atomic Power Constructions Ltd.). British Patent 946,655. Jan. 15, 1964. Filed Sept. 17, 1958.

A heat exchanger was designed with a cylindrical surface with a plurality outward extending, helically arranged fins and a number of longitudinally disposed flow splitters extending outward from the surface, or a plurality of outward extending longitudinally arranged fins and a number of helically disposed flow splitters extending outward from the surface. The outer portion of each flow splitter is curved to an extent sufficient, in use, to reduce turbulence created in the path of fluid striking one or both faces of the splitter and thereby being diverted. Examples of this heat exchanger being incorporated in the cans of fuel elements of a nuclear reactor are described. (M.C.G.)

8471 FLUID-TIGHT INTERCOMMUNICATION AND DISCONNECTING DEVICE FOR TWO SUPERPOSED CHAMBERS. Jean Blin and André Valentin (Commissariat à l'Energie Atomique). U. S. Patent 3,116,767. Jan. 7, 1964. Priority date Nov. 6, 1959, France.

An opening and closing device between two superposed fluid-tight chambers of nonmagnetic material for introduction or removal of contaminated materials from one chamber to the other and allowing separation of the chambers without contamination spreading to the outside atmosphere is described. It is formed of two covers fitting closely one within the other. The upper cover, covering the lower cover, is retractable toward the interior of the upper fluid-tight chamber and is made of a nonmagnetic material. This cover rests on a flange on the upper fluid-tight chamber and borders the opening of the chamber. The lower cover is retractable toward the outside of the lower fluid-tight chamber and rests on the edges of the opening in it. The seal is liquid and dense at the moment of opening and closing the device. (M.C.G.)

Heat Transfer and Fluid Flow

8472 (APAE-112(Vol.II)) 30 MEGAWATT HEAT EXCHANGER AND STEAM GENERATOR FOR SODIUM COOLED REACTOR SYSTEM. VOLUME II. CHEMICAL AND STRESS ANALYSIS. (Alco Products, Inc., Schenectady, N. Y.). Feb. 28, 1962. Contract AT(11-1)-666. 271p.

The chemical engineering analysis and stress analysis for design of the 30-Mw intermediate heat exchanger and steam generator for service with a liquid-sodium heat-transfer fluid are presented. The chemical engineering analysis includes the inert-cover-gas system, control of liquid level, and design provisions for system pressure relief. Consideration is given to possible hazards resulting from a steam-to-sodium leak. The stress analysis section covers those thermal transients that would be physically possible with this intermediate heat exchanger and steam generator design. Attention was given to methods of operation that would minimize the magnitude and frequency of thermal shocks. A structural design basis for handling stress analysis of combined mechanical, hydrostatic, and thermal stresses and conditions for using creep and stress-rupture properties is included. (M.C.G.)

8473 (BAW-1287) NON-UNIFORM HEAT GENERATION EXPERIMENTAL PROGRAM. Quarterly Technical Report No. 1, July–September 1963. D. F. Judd, R. H. Wilson (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.); H. S. Swenson, R. A. Lee, and J. W. Ackerman (Babcock and Wilcox Co. Research Center, Alliance, Ohio). Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3238. 20p.

Experimental and analytical investigations to determine the effects of irregular heat flow through reactor channels on the operating conditions that cause burnout (departure from nucleate boiling) are being planned. Tubular specimens having four axial power shapes and annular specimens having five power shapes will be used, and an effort to correlate the experimental data with empirical and analytical models will be made. The experimental program will be conducted on a vertical test section in a closed loop through which water is circulated at a given rate. A 1.8-Mw d-c power supply will heat the test section. (auth)

8474 (BSD-TDR-63-47) THEORY OF END WALL HEAT TRANSFER IN A MONATOMIC GAS, INCLUDING IONIZATION EFFECTS. Research Report 166. J. A. Fay and N. H. Kemp (Avco Corp. Avco-Everett Research Lab., Mar. 1963. Contract AF04(694)-33. 25p. (AD-425461)

The convective heat transfer rate to the end wall of a shock tube from a monatomic gas heated by a reflected shock is calculated. A range of shock strengths for which the equilibrium thermodynamic state is one of appreciable ionization is considered. The resulting boundary layer problem involves the thermal conductivity and ambipolar diffusion coefficient for a partially ionized monatomic gas. The formulation is restricted to the case of a catalytic wall and equal temperatures for all species. The effect of the plasma sheath at the wall is ignored. Consideration is given to three limiting cases for which similarity-type solutions of the boundary layer equations may be found: complete thermodynamic equilibrium behind the reflected shock and within the boundary layer; equilibrium behind the reflected shock, but no gas-phase recombination in the boundary layer; no ionization in either region. Numerical calculations are carried out for argon using estimated values of thermal conductivity and ambipolar diffusion, and compared with shock tube experiments of Camac. For no ionization, calculations were made with thermal conductivity varying as the $^3/_4$ power of the temperature, which fits the estimates of Amdur up to 15,000°K. Excellent agreement with experiment is obtained confirming an extrapolation of this power law up to 65,000°K. For ionized cases, based on estimates of Fay, the theory predicts heating rates 20 to 40% lower than measured values. Some possible reasons for this discrepancy are discussed. (auth)

8475 (EURAEC-661) HEAT TRANSFER AND STABILITY STUDIES IN BOILING WATER REACTORS. Quarterly Progress Report No. 9, January 1, 1963–April 1, 1963. (Eindohoven, Netherlands. Technische Hogeschool). May 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 032-60-11-RDH. 37p.

Progress has been made in developing the instrumentation for the measurements in steady and nonsteady states. The accuracy of the radioactive method for void fraction measurement has been further improved by stabilization of the main supply of 220 v and the 6.3 v supply for the tubes. Further improvement has been obtained by centering the source in another way and by changing the mixing unit. The calibrations for the capacitance method were continued. The characteristics of the gauge are similar to those of a plate capacitance. The technique for measuring the transfer functions from power to the dependent variables has been further developed. A Transfer Function Analyzer suitable for a point to point measurement has been ordered. The steady state and hydraulic instability experiments using a single rod annulus geometry were continued. Special attention has been paid to the void fraction measurements and the analysis of the signal of the differential pressure across the inlet. A break-down in the program has been encountered caused by an unexpected burn-out. In the atmospheric boiling loop, hydraulic oscillations of about 2 seconds period could be observed. The testing of the digital computer programme for calculating the recirculation rate in test loops has been finished. A preliminary analysis has been started to the influence of heat flux distribution, geometry and the correlations used for the slipfactor, two-phase friction, and other losses on the void fraction and recirculation rate. The theoretical study based on first principles on the behavior of a boiling loop has been finished. Interesting results concerning similarity parameters and theoretical expressions for the frictional pressure drop under boiling conditions have been obtained. Descriptions of the loop behavior starting from the known laws of conservation are under way. One has been programmed for the digital computer and incorporates non-linear effects. In the second description small deviations from the steady state have been assumed. This linearized model has been programmed for the analogue computer. (auth)

8476 (EURAEC-830) AN ADVANCED RESEARCH PROGRAM ON THE APPLICATION OF STEAM–WATER SPRAY TO THE COOLING OF LIGHT WATER REACTORS. CAN-2 Quarterly Progress Report No. 9, July 1–September 30, 1963. (Centro Informazioni Studi Esperienze, Milan). Sept. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 060-61-7-RDI. 10p. (CISE-R-84)

Heat transfer experiments were pursued in order to measure critical heat flux in round tubes at different pressures (51, 71.5, and 91 kg/cm^2) and geometries. Special experiments were devoted to investigate the phenomena involved in the crisis. For this purpose a particular test element was used in which two adjacent sections could be heated separately. Preliminary tests on the new built annulus were successfully carried out. The hydrodynamic loop was operated for the completion of the measurements of shear stress on the wall, and of the mean density of the mixture, with argon–ethyl alcohol mixture at different pressures. The main experimental work was devoted to the development of the apparatus to measure the liquid hold-up in the test section, through the liquid level variation in the separator. Systematic experiments were performed with this facility using argon–ethyl alcohol mixtures at various pressure. Corrosion tests on Zircaloy-2 in presence of steam–water mixtures were pursued. In the meanwhile corrosion tests in presence of 2 or 4 ppm of hydrogen in solution begun. Systematic metallographic examinations were carried out to study the nature and thickness of the oxide layer and the morphology of Zircaloy-2 samples used in corrosion tests. The oxide layer was also examined by capacity measurements using a special electric device. (auth)

8477 (EURAEC-856) THEORETICAL AND EXPERIMENTAL RESULTS ON STEADY STATE BOILING IN AN ANNULAR GEOMETRY. Special Technical Report No. 9. C. L. Spigt, F. L. M. Dijkman, J. D. Callen, and M. Bogaardt (Eindhoven, Netherlands. Technische Hogeschool). Sept. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 032-60-11-RDH. 51p.

A description is given of the results obtained on the natural circulation boiling loop. Mass flow and void fraction are reported as a function of input power, pressure, and inlet subcooling for annular geometry. The results are compared with a mathematical model that has been constructed for this loop. The model takes care of the effects

of the phase losses, slip, subcooled boiling, and of the axial variation of saturation temperature of the liquid. (auth)

8478 (EURAEC-862) LARGE SCALE EXPERIMENTS ON HEAT TRANSFER AND HYDRODYNAMICS WITH STEAM–WATER MIXTURES: DESCRIPTION OF THE EXPERIMENTAL PLANT. Topical Report No. 1. N. Adorni, A. Alessandrini, G. Peterlongo, and R. Ravetta (Centro Informazioni Studi Esperienze, Milan). Aug. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 056-62-1-RDI. 87p. (CISE-R-79)

This report describes the CISE experimental plant in Genova, designed to perform large scale experiments on heat transfer and hydrodynamics with steam–water mixtures. The main characteristics of the plant are: open loop, with separate inlet and outlet of water and steam from the test assembly; thermal power: 9 Mw; electrical power to the test element: 1 Mw; standard operating pressure 51 kg/cm^2 abs. (auth)

8479 (EURAEC-885) ON THE HYDRODYNAMIC ASPECTS OF TWO-PHASE FLOWS IN VERTICAL BOILERS. PART I. THEORY. PART II. APPENDICES A, B AND C. Special Technical Report No. 11 and Supplement. F. van der Walle and H. J. Lamein (Eindhoven, Netherlands. Technische Hogeschool). Oct. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 032-60-11-RDH. 81p.

From a literature survey, it is shown that the understanding of the behavior of vertical boilers is possible only when a theoretical model is formulated for the flow processes inside the boiler. Results are presented of a study of the possibilities of such a model for the bubble flow regime in an axi-symmetric boiler. The approximations of the generation, growth, and slip of bubbles are discussed. The derivation of equations and the formulation of similarity parameters are given. The set of partial differential equations is reduced to a system of ordinary differential equations. (D.L.C.)

8480 (GEAP-4395) PREDICTION OF TWO-PHASE CRITICAL FLOW RATE. S. Levy (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Oct. 1963. Contract AT(04-3)-189. 22p.

An analytical model to predict two-phase critical flow rate is proposed. The model is based upon thermal equilibrium, a "lumped" treatment of the two-phase velocity (each phase is represented by a single mean velocity), and the neglect of frictional and hydrostatic pressure losses. A comparison of the proposed predictions with available test results and previous analyses shows that the present model agrees very well with the published test data, and in contrast to all other analyses, the model requires no assumption about the gas void fraction. (auth)

8481 (GEAP-4487) TRANSITION BOILING HEAT TRANSFER PROGRAM. Fourth Quarterly Progress Report, October–December 1963. E. P. Quinn (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Jan. 1, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(04-3)-189. 25p. (EURAEC-940)

Heat-transfer tests employing the two-rod test section without film tripping devices are completed. Representations defining critical heat flux, transition boiling, and film boiling behavior at high pressures and over a steam quality range of 25 to 90% are shown. Fabrication of a new observational test section is completed, and initial test results with high-speed motion pictures are obtained. A test loop instability which is found to affect transition boiling behavior is detected and partially eliminated. (auth)

8482 (KAPL-2295) PREDICTION OF TWO-PHASE FLUID HOLDUP VAPOR FRACTIONS. D. A. Feingold (Knolls Atomic Power Lab., Schenectady, N. Y.). July 15, 1963. Contract W-31-109-eng-52. 18p.

This report deals with one small part of the overall problem of analyzing two-phase flow: i.e., the prediction of vapor fraction for the vertical co-current countergravity flow of water and steam in a pipe. The study, in general, deals with a macroscopic analysis instead of defining the actual turbulence and the other microscopic effects that manifest themselves in two-phase flow. In addition, it has been implicitly assumed that homogeneous conditions exist transversely to the direction of flow, although relative velocities on the average between the two phases are permitted. The analysis and correlation presented are primarily intended for the mixed-flow regime. However, it could very well be valid for other conditions. The presented correlations may also be valid for other geometries and fluids, but this must be verified experimentally. (auth)

8483 (NP-13517) CAVITATION DAMAGE MEASUREMENTS IN MERCURY BY RADIOTRACER ANALYSIS. Technical Report No. 10. Willy Smith, Juan M. Nieto, and Frederick G. Hammitt (Michigan. Univ., Ann Arbor. Coll. of Engineering). Oct. 1963. 76p. (ORA-03424-10-T).

The development of a method of continuous measurement of the wear of metal specimens submitted to a constant cavitation field by using radiotracer techniques was attempted. Samples of type 302 stainless steel and type 1010 carbon steel were irradiated in a nuclear reactor and then placed in a cavitating venturi in a closed-loop mercury facility. It was discovered that due to the arrangement of the centrifugal pump, the radioactive particles of steel separate at once and tend to be trapped on the liquid surface of the pump sump. By dismantling this sump, about 6% of the measured weight loss of the carbon steel specimens was recovered. This radioactive material was collected and filtered, which allowed a classification by size with the following results: 68.95% of the material was retained on a 53 micron filter, 30.75% was retained on a 10 micron filter, and 0.307% was retained on a 2 micron filter. These results were obtained by comparison of the activity of the debris with the activity of a standard sample prepared from the original irradiated specimen. Differential curves obtained for the different size debris indicate that the constituents do not vary with particle size. On the assumption that the particles are spheres, it was found that the size distribution of the debris recovered was as follows: 6000 particles with a diameter of 53 microns, 14,750 with an average diameter of 30 microns, and 18,400 with an average diameter of 6 microns. Very few particles exceed a diameter of 80 microns (3.15 mils) and very few have a dimension of less than 6 microns (.236 mils). (auth)

8484 (NP-13518) DETERMINATION OF CAVITATION CONDITIONS FROM DENSITY PROFILES OF MERCURY IN A VENTURI. Technical Report No. 11. Ian E. B. Lauchlan, Frederick G. Hammitt, Richard D. Ivany, M. John Robinson, and Willy Smith (Michigan. Univ., Ann Arbor. Coll. of Engineering). Oct. 1963. 44p. (ORA-03424-11-T).

The extent of the cavitation in mercury flowing in a transparent, Plexiglas venturi can be determined by measuring the decrease in the attenuation of a well collimated, Co^{60}, gamma beam in passing through the venturi when

voids resulting from cavitation are present. Experimental results for the axial fluid density profile are consistent with the visual appearance of the cavitating flow. (auth)

8485 (NYO-10488) QUARTERLY PROGRESS REPORT [ON ANNULAR TWO-PHASE FLOW], JULY–SEPTEMBER 1963. G. B. Wallis, D. A. Steen, S. N. Brenner, and J. M. Turner (Dartmouth Coll., Hanover, N. H.). Oct. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT (30-1)-3114. 42p. (EURAEC-825)

High-speed motion picture studies of the break-up of a liquid film in annular two-phase flow are reported. Droplet entrainment is shown to originate from large disturbance waves on the film. The onset of entrainment is found to occur at the same gas velocity in both upwards and downwards co-current flow. Pressure drop, void fraction, and entrainment studies in the region between slug and annular upwards flow are described. Various methods of defining flow regime changes in this range are discussed. A possible method of dimensionless representation of results in this region is indicated, and a preliminary comparison with the results of others is made. (auth)

8486 (SAN-1010) A HIGH-PRESSURE TEST FACILITY FOR TRANSIENT BOILING STUDIES. Report No. HPS-63-1. S. Fabic, H. A. Johnson, and V. E. Schrock (California. Univ., Berkeley. Inst. of Engineering Research). June 1963. Contract AT(11-1)-34. 98p.

A description is given of the test facility for studying the mechanism of transient boiling heat transfer and steam void formation. The loop comprises a high-pressure system and either a visual or an x-ray test chamber. Studies on transient and steady-state boiling are conducted by passing a current through a ribbon in the visual test chamber, measuring the temperature by using the ribbon as a resistance thermometer, and recording the event of boiling by high-speed photography or x-ray absorption. (D.L.C.)

8487 (WAPD-BT-29(p.69-79)) MATRIX CONDITIONING FOR ALTERNATING DIRECTION. J. Spanier and W. H. Guilinger, Jr. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Attention is focused on the commutatively of certain matrix operators which arise in connection with alternating direction iterative methods. Matrix transformations are applied which essentially extend the class of problems for which commutativity holds. Results are obtained for both the steady-state and transient heat condition equations. (auth)

8488 (AEC-tr-6282) ON THE THEORY OF THE LUDWIG-SORET EFFECT. B. Bruže. Translated for Oak Ridge National Lab., Tenn., from Z. Physik. Chem. (Leipzig), 157A: 422-34(1931). 18p.

A theory was developed by which the Ludwig-Soret effect can be solved by the application of thermodynamics and the laws of stationary heat flow. The Soret coefficient can be predicted from purely thermodynamic properties of the solution. The Ludwig-Soret effect is a special case of a general dynamic effect. (P.C.H.)

8489 (AEC-tr-6287) EFFECT OF CHANNEL DIAMETER ON CRITICAL HEAT LOADS. V. E. (Ye.) Doroshchuk and F. P. Lantsman. Translated for Westinghouse Electric Corp., Bettis Atomic Power Lab., Pittsburgh, from Teploenerg., 10: No. 8, 73-6(1963). 9p.

An experimental investigation was carried out to determine the critical heat load q_{cr} for water and steam–water mixtures flowing in tubes of different diameters. Measurements were made at diameters of 3 to 8 mm and pressures of 50 to 170 atm abs, using a mass flow rate of 2,860 kg/m^2-sec. The results are described by the equation $q_{cr}/q_o = 1 + A/q_o(\sqrt{8/d} - 1)$, where q_o = critical heat load for a 8-mm 8-mm tube, d = diameter, and A = a pressure-dependent coefficient (6.9 at 50 atm and 5.4 at 170 atm). The results are in good agreement with other investigations made under different conditions. (D.L.C.)

8490 (AEC-tr-6291) CRITICAL HEAT LOADS FOR AN EXTERNAL LOW-VELOCITY FLOW OF SUBCOOLED WATER AROUND A TUBE IN A SQUARE CHANNEL. B. A. Zenkevich and O. V. Remizov. Translated for Westinghouse Electric Corp., Bettis Atomic Power Lab., Pittsburgh, from Inzh.-Fiz. Zh., Akad. Nauk Belorussk. SSR, 6: 112-15(1963). 6p.

A study was made of the boiling crisis in the flow of water around a tube in a square channel. The critical heat loads were determined at absolute pressures of 29.4×10^5 to 147 to 10^5 n-m^2, flow velocities of 0.1 to 3.0 m/sec, and Δt_{sub} of 2 to 50°C. The results show that the hydrodynamics of internal and external flow are different, particularly at low velocities. Equations were derived to describe the results. (D.L.C.)

8491 (EURAEC-809) MEASUREMENT OF THE VACUUM FRACTION ON SECTION-4 RODS BY GAMMA RAY ABSORPTION. Special Report No. S.11. A. Beghin (Société Nationale d'Étude et de Construction de Moteurs d'Activation, Suresnes, France). May 10, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7-RDF. (A translation)

Gamma-ray-absorption measurements were made on the four rod and lobed sides test section using an air–water mixture, in order to cross-check the void fractions (α) obtained by the conducting burst method. The test section was used with and without cruciform twisted tape. The gamma measurements were found to be accurate for $\alpha < 0.85$, and the validity of the conducting burst method was confirmed. The measurement of local α values by gamma measurement is discussed. (D.L.C.)

8492 (EURAEC-810) INFLUENCE OF THE CRITICAL FLUXES OF VORTICES INDUCED IN BOILING WATER AT LOW PRESSURE. Report No. S 12. J. Volterras and G. Tournier (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes, France). June 17, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7 RDF. 41p. (A translation)

A study was made to determine the maximum permitted flux in relation to mass velocity, using a test section of four heating rods which simulates a reactor assembly. The test section also includes a lining with lobed sides, and is used with and without cruciform twisted tape. Results are given of measurements at low pressures. (D.L.C.)

8493 DIFFUSION AND BACK-FLOW MODELS FOR TWO-PHASE AXIAL DISPERSION. Terukatsu Miyauchi (Tokyo Univ.) and Theodore Vermeulen. Ind. Eng. Chem. Fundamentals, 2: 304-10(Nov. 1963). (UCRL-11016)

Two-phase flow operations are described by a generalized model that assumes back flow, superimposed on the net flows through a column, with perfectly mixed stages in cascade. The diffusion model, which is used extensively to describe longitudinal dispersion, is derived as an extreme case of the back-flow model. The perfectly mixed stage (or cell) model is derived as another extreme. It is shown that the dispersed phase for these models may

be treated as a second continuous phase. The nature of the longitudinal dispersion coefficient was also examined. (auth)

8494 BOILING HEAT TRANSFER IN ZERO GRAVITY. Eugene A. Zara (Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio). RTD Technol. Briefs, 2: No. 11, 8-15(Jan. 1964).

The preliminary results of a research program to determine the effects of zero and near zero gravity on boiling heat transfer are presented. Zero gravity conditions were obtained on the ASD KC-135 zero gravity test aircraft, capable of providing 30-seconds of zero gravity. Results of the program to date indicate that nucleate (bubble) boiling heat transfer rates are not greatly affected by the absence of gravity forces. However, radical pressure increases were observed that will dictate special design considerations to space vehicle systems utilizing pool boiling processes, such as cryogenic or other fluid storage vessels where thermal input to the fluid is used for vessel pressurization. (auth)

8495 FLOW BETWEEN TWO PARALLEL WALLS IN A PERIODIC MAGNETIC FIELD. I. B. Chekmarev. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 5, 144-5(Sept.-Oct. 1963). (In Russian)

Steady two-dimensional flow of conducting viscous flow in the presence of a nonuniform magnetic field was studied for the case of strongly varying transverse channel flow and weakly varying magnetic field and longitudinal flow. (R.V.J.)

8496 ON SPHERICAL VORTEX SOURCES IN MAGNETO-HYDRODYNAMICS. G. P. Dikii (Khar'kov Aviation Inst.). Zh. Tekhn. Fiz., 33: 1285-9(Nov. 1963). (In Russian)

Spherical vortex flow, which is the flow of a viscous fluid generated by a uniformly rotating sphere, is investigated. Magnetohydrodynamic equations for a viscous incompressible fluid with finite conductivity are used to investigate spherical vortex flow in the presence of a point source (drain) and a magnetic field. Exact solutions, expressed in terms of elementary functions, were obtained for three individual cases. (tr-auth)

8497 EFFECTS OF EXTERNAL ELECTROSTATIC FIELD ON LAMINAR FLOW OF CHARGED FLUID IN A FLAT TUBE. G. N. Kopylov. Zh. Tekhn. Fiz., 33: 1290-1300(Nov. 1963). (In Russian)

An accurate solution was found for electrohydrodynamic flow of liquid in a flat tube, and the effects of external electrostatic fields of various intensities and directions on the character of flow parameters were determined. It was shown that the acceleration of flow by electrohydrodynamic means is inhibited by transverse fields. (R.V.J.)

8498 ON PLANE-PARALLEL FLUID FLOW WITH TIME-DEPENDENT CONDUCTIVITY IN A TRANSVERSE MAGNETIC FIELD. G. A. Grinberg (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 33: 1384-7(Nov. 1963). (In Russian)

An analysis was made of the magnetohydrodynamic problem of plane-parallel flow of incompressible viscous fluid in which the conductivity (σ) is a function of time. General concepts of the problem are illustrated using the function $\sigma = (\sigma_0)/(1 - t/T)$ (where σ_0 and T are constants). (tr-auth)

8499 HEAT-TRANSFER AND FLOW DATA WITH CRYOGENIC HYDROGEN FOR NUCLEAR ROCKET SYSTEM DESIGN. David M. Straight (Lewis Research Center, Cleveland). 28p. (CONF-382-1)

From American Society of Heating, Refrigerating, and Air Conditioning Engineers Cryogenic Symposium, New York, Feb. 1963.

The design of nuclear rocket propellant-feed and reactor systems requires knowledge of heat-transfer and flow phenomena with cryogenic and gaseous hydrogen. The results of some recent experimental studies on heat transfer and pressure drop for two-phase and gaseous hydrogen flow at temperatures from 36 to 500°R and pressures from 1 to 3 atmospheres are presented. A description and diagrams of the apparatus and a brief summary of some current tests are included. The data are presented in the form of the usual heat-transfer parameters, Nusselt, Reynolds, and Prandtl numbers, and also include a Martinelli parameter and a boiling number for two-phase flow conditions. Pressure-drop data are presented as a comparison with calculated values from standard pressure-drop equations. (auth)

8500 FRICTION FACTORS FOR FULLY DEVELOPED TURBULENT FLOW IN DUCTS WITH AND WITHOUT HEAT TRANSFER. G. W. Maurer and B. W. LeTourneau (Westinghouse Electric Corp., Pittsburgh, Penna.). New York, American Society of Mechanical Engineers, 1963, Paper No. 63-WA-98, 10p. (CONF-102-18)

From American Society of Mechanical Engineers 1963 Winter Meeting, Philadelphia, Nov. 1963.

Tests were performed with water flowing vertically upward through a 0.087-in. × 1-in. × 27-in. long rectangular channel to determine friction factors with and without heat transfer. The following range of variables was covered: mass velocities: 0.60×10^6 to 4.0×10^6 $lb_m/hr\text{-}ft^2$, heat flux: 0 to 1.6×10^6 $Btu/hr\text{-}ft^2$, inlet temperature: 59 to 510 deg F, pressures: 300 to 2000 psia. The isothermal data confirmed the use of the hydraulic equivalent diameter with the conventional circular tube friction factors for narrow rectangular channels at Reynolds numbers from 4×10^3 to 5×10^5. Using the results of the heated tests and the data existing in the literature, a general correlation was formulated that correlated the data for both water and air. (auth)

Materials Testing

8501 (HW-76246(App.I)) EVALUATION OF ULTRASONIC MONITORING OF NPR VIBRATION FATIGUE SPECIMENS. Investigation No. 853-3. E. V. Allen and F. M. Coffman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 28, 1963. Contract AT (45-1)-1350. 78p.

Twelve NPR primary loop vibration fatigue specimens were tested and examined to determine the feasibility of monitoring the NPR primary loop piping in service. Studies were made to evaluate correlation between ultrasonic signal response amplitudes, initial weld defect sizes, and fatigue crack sizes. The pipe was non-destructively and destructively evaluated. (auth)

8502 (HW-SA-3108) AUTOMATIC PROCESSING MECHANICAL PROPERTIES DATA. A. L. Bement and J. E. Irvin (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 21, 1963. Contract AT (45-1)-1350. 22p. (CONF-356-6)

From 1963 American Society of Metals/Metals and Materials Show, Cleveland, Oct. 1963, 23rd National Convention of the Society for Nondestructive Testing.

The use of computers to collect and analyze metallurgical data is explained. Two FORTRAN programs for the

IBM 7090 are described. The TEND program routinely processes raw tensile data into most of the useful conventional and true stress-strain parameters. The processing steps employed from the actual tensile test to the computer output report are outlined. The multipurpose REM (Radiation Effects on Materials) program performs several tasks in information storage and processing. (D.C.W.)

8503 (SC-4944(RR)) THE SANDIA APAR-3G SYSTEM. AUTOMATIC PROGRAMMING, RECORDING, AND CONTROL FOR DEVELOPMENT AND PRODUCTION TESTING. R. W. Roberts (Sandia Lab., Albuquerque, N. Mex.). Dec. 1963. Contract AT(29-1)-789. 34p.

The APAR-3G system, which is readily adaptable to a wide variety of automated data acquisition and control system applications, is described. It is physically and logically modular to permit the assembly of minimum or maximum capability machines. The system can perform the necessary acquisition and control in a typical factory environment and can generate an output (for data reduction) that is compatible with available computer systems. (auth)

8504 (EURAEC-605) SPECIAL REPORT NO. 5 CONCERNING DESIGN AND CONSTRUCTION OF A 6000-TON TESTING MACHINE: FEBRUARY 1–AUGUST 1, 1962. (Ghent. Universiteit). Work Performed under United States–Euratom Joint Research and Development Program. Contract 002-61-12-DIV-B. 77p. (A translation)

The design, development, and construction of a 6000-ton testing machine are investigated. (N.W.R.)

8505 MEASUREMENT OF THE DISTRIBUTION OF STRAY RADIATION WHILE X-RAY IS RADIATED. Tadaaki Onishi (Hitachi Shipbuilding and Engineering Co., Ltd., Japan). Hitachi Zosen Giho, 24: 238-44(Aug. 1963). (In Japanese)

The distribution of stray radiation was measured in the factory when radiographic examinations were performed for the purpose of defining the area in which laborers employed in x-ray examination may be subjected to unhealthy effects from scattered x ray beyond the maximum permissible limit prescribed in the "Regulations for the Protection against Accident of Workers caused by Ionized Radiant Ray." (auth)

8506 STRAY AND SCATTERED RADIATION INTENSITY AND ENERGY DISTRIBUTIONS OF A 15 Mev BETATRON USED FOR NONDESTRUCTIVE MATERIALS TESTING. H.-U. Richter and E. Moewes (VEB Schwermaschinenbau Karl Libknecht, Magdeburg, Ger.). Kernenergie, 6: 634-43(Nov. 1963). (In German)

In a continuation of the study of the intensity and energy distributions of stray and scattered radiation from a 15-Mev betatron, results of measurements are presented in tables and graphs. Errors in measurement are estimated. The allowability of conclusions from the ion dose is discussed. (M.C.G.)

8507 BASIC RADIATION PHYSICS DATA FOR INSPECTION SYSTEM DESIGN. D. L. Dye (Boeing Co., Seattle). 23p. (CONF-310-2)

From Symposium on Physics and Nondestructive Testing, San Antonio, Oct. 1963.

A number of gaps in understanding exist in the basic physics of high-energy radiography. Using a 10- or 25-Mev research linac, experiments are being planned to fill in some of these gaps and to study high-energy radiographic parameters. Experimental planning to measure x-ray and secondary electron spectra is discussed, and preliminary results are presented. Means are indicated for relating these basic data to actual inspection system design. (auth)

8508 IMPROVEMENTS IN OR RELATING TO RADIOGRAPHIC TECHNIQUES. Kenneth Cotterell (to United Kingdom Atomic Energy Authority). British Patent 942,609. Nov. 27, 1963. Filed Aug. 25, 1961.

A method is discussed for radiographic examination of substances of low atomic number such as beryllium, beryllium oxides, and graphite. The parts to be examined are contacted with a volatile fluid with linear absorption coefficient large compared to that of the specimen. The fluid is a halogen-substituted aromatic or aliphatic hydrocarbon or carbon tetrachloride and x radiation of 5 to 25 kev is used. After examination the fluid is removed by heating under vacuum. (R.E.U.)

Protective Structures

8509 (CEX 59.7b(Part II)) COMPARISON OF MEASUREMENTS IN ABOVE-GROUND AND BELOW-GROUND STRUCTURES FROM SIMULATED AND ACTUAL FALLOUT RADIATION. Z. G. Burson (Edgerton, Germeshausen and Grier, Inc., Las Vegas, Nev. and Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.). [1962]. 68p.

An experimental study designed to provide a basis for estimating protection against fallout radiation was made on two types of structures at the Nevada Test Site. The two buildings studied were a lightly constructed building with a basement, and an underground group shelter. An idealized fallout radiation field was simulated by the use of a sealed radioactive Co^{60} source that was pumped at a uniform speed through a long length of flexible tubing evenly distributed over the area of interest. Radiation levels at selected points inside the structures were measured with sensitive ionization-chamber detectors. These measurements were compared with measurements taken under actual fallout conditions at an earlier time and were also compared with the theoretical calculations. Protection factors from fallout data and mobile radiological measurements (MRMU) at the basement structure compared roughly within a factor of 2. This was good, considering the limitations of the two sets of data and other factors affecting the differences. Comparisons between protection factors from fallout data and MRMU data at the underground group shelter were excellent. MRMU data and theoretical calculations also compared satisfactorily. (auth)

Vacuum Engineering

8510 (63-RL-3441E) FAST-ACTING ELECTROMECHANICAL GAS VALVE. W. B. Jones (General Electric Co. Research Lab., Schenectady, N. Y.). Sept. 1963. 6p.

A poppet-type pulsed valve is described which admits metered bursts of gas into a vacuum system. The valve is electromagnetically activated, fast acting, and precisely triggerable. It is of reentrant design. The volume of the plenum of the valve described is 0.5 cc. The plenum is emptied each time the valve is pulsed. Using the valve to admit hydrogen gas into a system of high pumping speed, the hydrogen density reaches a maximum at a point 5 cm from the valve head in approximately 60 μsec after gas begins flowing from the valve. (auth)

8511 ULTRAHIGH VACUUM LEAK SEALING MATERIAL. J. R. Young (General Electric Vacuum Products Operation, Schenectady, N. Y.). Rev. Sci. Instr., 35: 116 (Jan. 1964).

A silicon resin GE SR-82 is shown to be capable of sealing metal and glass systems with bakeout temperatures up

to 400°C and with 10^{-10} torr. Examples of its use and favorable results are given. (R.E.U.)

8512 MODERN METHODS IN ULTRAHIGH-VACUUM TECHNIQUES. E. M. Reikhrudel and G. V. Smirnitskaya (Moscow State Univ.). Zh. Tekhn. Fiz., 33: 1405-29(Dec. 1963). (In Russian)

Methods and techniques for developing ultra-high vacuum are discussed. Performance and characteristics of various ultra-high vacuum pumps (sorption-evaporation, sorption-ion-evaporation, sorption-ion-diffusion, and turbo-molecular) are described. 94 references. (R.V.J.)

8513 CALCULATION METHODS FOR THE DESIGN OF REGENERATIVE CRYOSORPTION PUMPING SYSTEMS. Milton Manes and R. J. Grant (Pittsburgh Chemical Co.). 18p. (CONF-209-16)

From American Vacuum Society Meeting, Boston, Oct. 1963.

Adsorption isotherms over a very wide range of temperatures and pressures, as required for equilibrium calculations on regenerative cryosorption pumping systems from rough to ultrahigh vacuum, may be conveniently estimated from a minimum of data by methods based on adsorption potential theory. Illustrative calculated isotherms of nitrogen, hydrogen, and helium on two activated carbons all show considerable capacity to very low pressures at the respective (atmospheric) boiling points. Performance improves in this series with decreasing boiling point; for example, cryosorption on activated carbon at 4°K, with only modest pre-evacuation, should considerably extend present limits of attainable vacuum. (auth)

8514 CONTINUOUS CRYOTRAPPING OF HYDROGEN AND HELIUM BY ARGON AT 4.2°K. J. Hengevoss and E. A. Trendelenburg (Balzers AG, fur Hochvakuumtechnik und Dunne Schichten, Liechtenstein, Switzerland). 12p. (CONF-209-13)

From American Vacuum Society Meeting, Boston, Oct. 1963.

In vacuum systems equipped with cryopumps, it is only possible to pump residual gas components that at the ultimate pressure and at the condensation surface temperature have the character of oversaturated vapors. It was found that in the presence of argon unsaturated vapors of He and H_2 can be trapped at the condensation surface. This effect, called the cryotrapping effect, was investigated at 4.2°K. (C.E.S.)

GEOLOGY AND MINERALOGY

General

8515 AERIAL PROSPECTING OF URANIUM ORES IN WOODED REGIONS. V. I. Balabanov and A. L. Kovalevskiĭ. At. Energ. (USSR), 15: 432-4(Nov. 1963). (In Russian)

Although trees absorb part of the radiation emitted by the soil, the biomass may be itself an emitter as the above-ground portion of the plants may contain Ra. Ashes of the branches of birch, fir, spruce, larch, and other trees may contain 1.5 to 3 times more Ra than the ground. Such abnormally high Ra concentrations in the above-ground portions of trees growing in U-bearing soil may thus create "γ anomalies" of 0.4 to 0.9 μC/hr at a height of 40 to 50 m above the ground. For calculation, the forest areas are divided in 3 horizontal layers: the crest, the trunks, and the dead ground cover. Equations were derived for determining the dose rate attributable to these layers. Three factors affect the aerial logging: specific geophysical processes, noted especially in acid forest soils, which tend to deplete the U minerals at a depth from 0.5 to 1 m; absorption of Ra in the above-ground portions of the vegetation, creating biochemical anomalies; and absorption of the γ radiation, emitted by the soil, by the vegetation. (TTT)

Natural Radioactivity and Fallout

Refer also to abstract 8284.

8516 (HNS-1229-21) GROUND WATER STUDY PROGRAM. AN APPRAISAL OF THE DISTRIBUTION COEFFICIENT FOR ESTIMATING UNDERGROUND MOVEMENT OF RADIOISOTOPES. Warren J. Kaufman (Hazleton-Nuclear Science Corp., Palo Alto, Calif.). Mar. 1963. Revised: Apr. 1963. Contract AT(29-2)-1229. 26p.

The distribution coefficient is used to describe the relative affinity of an ion for the solid and liquid phases of an exchange system. It is normally expressed as the ratio of the concentration of a single ionic species or radionuclide on a solid to that in the adjacent liquid. The distribution coefficient is directly proportional to the selectivity of the exchanger and to its exchange capacity. It is inversely proportional to the concentration of competing ions in the liquid. The distribution coefficients of cesium and strontium in natural ground waters are of special interest in ascertaining the radiological hazards of underground nuclear explosions. The rate of transport of these ions is inversely proportional to their distribution coefficients, such that when contaminated waters of low mineral content traverse formations of high clay content, a very significant retardation of the contaminant occurs. In the case of cesium and certain clay minerals, a high degree of selectivity exists which may greatly enhance the retarding influence of the clay, even though the exchange capacity is quite small. This report is concerned with the relationship of the distribution coefficient to ground water-clay mineral systems and to the application of these coefficients to estimating the velocities of movement of cesium and strontium. (auth)

8517 (SC-DC-3553(p.219-29)) FALLOUT PREDICTION TECHNIQUES. J. Z. Holland and A. W. Klement, Jr. (Division of Biology and Medicine, AEC).

Fallout predictions for abortive space vehicles or vehicle reentry burnup, which would release radioactive particles into the stratosphere or upper atmosphere, are made from high-altitude nuclear weapons test data. The principal methods employed in predicting are gravitational settling and turbulent diffusion of particles, distribution of the total debris into a finite number of atmospheric reservoirs, and analogy with observed distributions from specific detonations. (R.E.U.)

8518 (AEC-tr-6049) RADIOACTIVE CONTAMINATION OF THE EXTERNAL ENVIRONMENT. V. P. Shvedov and S. I. Shirokov, eds. Translation of "Radioaktivnye Zapryazneniya Vneshnei Sredy" (a publication of the State Publishing House of Literature in the Field of Atomic Science and Technology, Moscow, 1962).

Separate abstracts were prepared for 14 papers included. A bibliography containing 422 pertinent references is included. A single abstract of the original Russian publication appeared in NSA as 17: 12516. (C.H.)

For abstracts of individual papers see: 8063, 8231, 8285, 8286, 8287, 8288, 8519, 8520, 8521, 8522, 8523, 8524, 8525, and 8650.

8519 (AEC-tr-6049(p.1-10)) METHODS OF SAMPLING AND PREPARATION FOR RADIOCHEMICAL ANALYSIS. N. A. Susorova. (Translation)

Methods are described for sampling the external environment for fallout radioactivity. Procedures are presented for the preparation of samples of aerosols, filter materials, rain water, surface water, soil, milk, and foods for radiometric analysis. (C.H.)

8520 (AEC-tr-6049(p.135-7)) METHOD OF CALCULATING THE EXTERNAL γ DOSE FROM RADIOACTIVE FALLOUT. G. V. Yakovleva. (Translation)

A method is described for calculating the external γ dose from radioactive fallout for a point situated one meter above the ground surface. Attempts are made to include the effects of secondary γ radiation. (C.H.)

8521 (AEC-tr-6049(p.138-60)) PROPERTIES OF RADIOACTIVE ISOTOPES FOUND IN THE EXTERNAL ENVIRONMENT. V. P. Shvedov. (Translation)

The radioisotopes encountered in nature can be divided into 3 groups: U and Th and their decay products; the radioisotopes formed under the action of cosmic radiation and nuclear reactions occurring in the stratosphere; and a group of sparsely distributed isotopes and isotopes with long half lives that are of no vital significance for processes occurring in the biosphere. The contributions of naturally occurring radioisotopes to the activity of the external environment are reviewed. The production of artificial radioactive isotopes during U^{235}, Pu^{239}, U^{233}, Th^{232}, and U^{238} fission is discussed. Data are tabulated on the yields and characteristics of the fission products. It is pointed out that the primary fission fragments are unstable and undergo a number of decays during the first few hours to isotopes with half lives ranging from several hours to millions of years. Formulas are presented for expressing the total activity and average energy of mixed fission products. (C.H.)

8522 (AEC-tr-6049(p.161-201)) DISTRIBUTION OF RADIOACTIVE FISSION PRODUCTS IN THE ATMOSPHERE AND GLOBAL FALLOUT. (Translation)

Factors affecting the distribution of radioactive fission products in the atmosphere and global fallout are discussed. Topics discussed in detail include the entry of fission products from nuclear explosions into the atmosphere, types of fallout particles, local fallout, processes that clean the troposphere, the adhesion of aerosol particles to the surface of ground objects and to the soil, coagulation of fallout with inactive aerosol particles, the capture of aerosol particles by the elements of natural clouds, the capture of aerosol particles by falling drops, pathways of migration in tropospheric transfer, the cleaning of the troposphere under various meteorological conditions, the rate of cleaning of the troposphere, the role of stratospheric transfer in world-wide radioactive contamination, the geographical distribution of global radioactive contamination, changes in the global radioactive contamination with time, the behavior of aerosols in the stratosphere, and the theory of fallout particle exchange between the stratosphere and troposphere. (C.H.)

8523 (AEC-tr-6049(p.202-24)) THE FALLOUT OF Sr^{90}, Cs^{137}, Ce^{144}, AND OTHER RADIOACTIVE ISOTOPES ONTO THE EARTH'S SURFACE AND THEIR CONTENT IN THE ATMOSPHERE. (Translation)

Data are reviewed on the content in the atmosphere of Sr^{90}, Cs^{137}, Ce^{144}, and other selected fallout radioisotopes from 1956 through 1960. Data are also included on fallout on the earth's surface at various locations during the same period. The influence of latitude, climatic conditions, and other variables on fallout deposition are discussed. (C.H.)

8524 (AEC-tr-6049(p.225-32)) THE CONTENT, DISTRIBUTION, AND MIGRATION OF LONG-LIVED FISSION PRODUCTS IN SOILS. V. P. Shvedov and V. K. Vinogradova. (Translation)

One of the basic links in the movement of fission products into the food chain is the soil. The sorption of radioactive products in soils depends on the chemical structure of the soil, its ion exchange capacity, the presence in the soil of ions close in chemical properties to the radioisotopes, the pH of the soil, and the movement of ground waters in the soil. Results are summarized from a number of studies on movement of Sr^{90} through soils. Data are included from measurements of the content of Sr^{90} in soil samples collected from 1956 to 1961 at various locations throughout the world. (C.H.)

8525 (AEC-tr-6049(p.233-57)) THE CONTENT AND DISTRIBUTION OF FISSION PRODUCTS IN WATER. (Translation)

The presence of natural radioactive elements must be considered in determinations of artificial radioactive isotopes in surface waters. Data are presented on the content of natural radioactivity in surface waters and drinking water supplies from various locations throughout the world. Procedures are presented for the determination of residual radioactivity and the activity of certain isotopes of fission product origin in samples of surface waters. The isotopes include Sr^{90}, Zr^{95}, Cs^{137}, Ru^{106}, and Ce^{144}. Data are summarized from measurements of Sr^{90} content in freshwater bodies of various countries, Sr^{90} and Cs^{137} content in waters of the Atlantic and Pacific Oceans and Sr^{90} content in water of the Black Sea. The measurements were made between 1956 and 1961. (C.H.)

8526 ACCELERATION OF SINKING RATES OF RADIONUCLIDES IN THE OCEAN. Charles Osterberg, Andrew G. Carey, Jr. and Herbert Curl, Jr. (Oregon State Univ., Corvallis). Nature, 200: 1276-7(Dec. 28, 1963).

Zirconium-95–niobium-95 and $Ce^{141-144}$ were detected by gamma spectrometry in two samples of sea-cucumbers collected off the Oregon coast west of Newport in April 1963. Sea-cucumbers of the genus Paelopatides were found at 2800 m, 65 miles offshore; Stichopus californicus were taken in 200 m of water 25 miles off Newport. The gamma spectra of the two benthic sediment feeders were remarkably similar, except for a lower Zn^{65} peak in the spectrum of Paelopatides sp. It is suggested that biological processes are responsible for the relative abundance of fission products in deep bottom feeders. It was concluded that fallout radionuclides can reach the ocean bottom quite rapidly under certain conditions, and it is proposed that the great numbers of herbivorous zooplankton in the upper layers of the ocean are largely responsible for this phenomenon. (P.C.H.)

8527 RADIOACTIVITY IN SURFACE WATERS OF THE UNITED STATES, 1957-1962. Leo Weaver, Alfred W. Hoadley, and Stanley Baker (Robert A. Taft Sanitary Engineering Center, Cincinnati). Radiol. Health Data, 4: 306-16(June 1963).

Levels of radioactivity in the surface waters of the U. S. under surveillance by the Public Health Service's National Water Quality Network are reported and evaluated. Included are data on Sr-90 levels and on gross beta and alpha activity. The latter include determinations on the suspended and dissolved fractions of the raw river waters and are presented graphically on a national and major river basin basis. Sampling methods and frequencies and analytical methods are described. (auth)

8528 IODINE-131 FALLOUT FROM UNDERGROUND TESTS. E. A. Martell (National Center for Atmospheric Research, Boulder, Colo.). Science, 143: 126-9(Jan. 10, 1964).

Evidence that the fallout of I^{131} in the Midwest during May 1962 originated in Nevada is provided by data on air trajectories, radioactivity in milk, and other findings. Selective escape of I^{131} from vented explosions, and the rapid transfer of I^{131} from the lower atmosphere to the biosphere, place significance on even minor releases of radioactive fission products from subsurface nuclear explosions. (auth)

8529 VARIATIONS IN THE RATIO Ca^{48}/(TOTAL Ca) IN THE NATURAL ENVIRONMENT. J. T. Corless and J. W. Winchester (Massachusetts Inst. of Tech., Cambridge). Vienna, International Atomic Energy Agency, 1963, Preprint SM-50/19, 12p. (CONF-269-8)

From International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, Dec. 1963.

A method was developed for determining the ratio Ca^{48}/(total Ca) in natural materials. The method consists of the independent measurement of the Ca^{48} and total calcium contents of the sample. The Ca^{48} is determined by precision neutron activation analysis using europium as an internal standard. The total calcium content of the sample is determined by an EDTA weight titration with a spectrophotometrically-determined end point. All Ca^{48}/(total Ca) ratios are determined relative to a reference standard which, for this initial study, was a reagent-grade $CaCO_3$. The uncertainty in the measurement of a Ca^{48}/(total Ca) ratio of a single sample is usually in the range ±0.2 to ±0.3%. The Ca^{48}/(total Ca) ratios of 21 samples representing geologic, oceanographic, and biological environments were meas-

ured. The samples studied included bones, teeth, sea water, marine organisms, meteorite and various minerals, including apatites, calcites, and carbonatites. Variations in the Ca^{48}/(total Ca) ratio of +5% to −6% were detected relative to the reference standard. The magnitude and character of these variations make it appear likely that the method should prove very useful as a geochemical tool. (P.C.H.)

8530 BIOLOGICAL AND ENVIRONMENTAL RADIATION EXPERIENCE AT INDIAN POINT STATION. 6p. (CONF-357-1)

From National Power Conference, Cincinnati, Sept. 1963. American Society of Mechanical Engineers Institute of Electrical and Electronics Engineers.

The environs monitoring program at Indian Point Station is presented. Thirty sampling stations within a circle of approximately 10 miles of the station are used for the collection of samples of air, water, vegetation, and soil that are then analyzed for gross beta-gamma activity. Data are tabulated. (P.C.H.)

Techniques and Equipment

8531 GLASS DATING BY FISSION FRAGMENT TRACKS. R. L. Fleischer and P. B. Price (General Electric Research Lab., Schenectady, N. Y.). J. Geophys. Res., 69: 331-9(Jan. 15, 1964).

The use of fission fragment damage tracks for dating of geological and other glasses is described and applied to a number of tektites and a Libyan glass. By comparison with K–Ar and Rb–Sr dates the decay constant for spontaneous fission of U^{238} is derived geologically to be 6.9×10^{-17} yr^{-1}. Most of the tektite dates are in good agreement with those established by K–Ar measurements. For Libyan glass the fission track age is 34 ± 6 m.y. Elevated temperature experiments indicate that tracks in tektites would be stable at 22°C for much longer than the age of the earth and could disappear within 100 million years only if the temperature of the glass had exceeded 170°C. A suggestion for a method of dating thermal histories is presented. (auth)

8532 YADERNAYA GEOFIZIKA, VYPUSK 1963. (Nuclear Geophysics, Issue 1963). F. A. Alekseev, ed. Moscow, Gosontekhizdat, 1963. 248p.

The theory and practice of radiation logging and field radiometry are considered. Applications of pulsed neutron methods and problems in geophysics are described. (R.V.J.)

Thorium and Uranium Minerals

8533 MIGRATSIYA IZOTOPOV URANA, RADIYA I TORIYA I INTERPRETATSIYA RADIOAKTIVNYKH ANOMALII. (Migration of Uranium, Radium, and Thorium Isotopes and Interpretation of Radioactive Anomalies). N. G. Syromyatnikov. Alma-Ata, USSR, Publishing House of the Kazakh SSR Academy of Sciences, 1961, 79p.

Isotopic migration of U, Th, and Ra was studied and a method was developed for interpreting radiohydrochemical anomalies by their isotopic content. The suggested methods estimates aqueous anomalies by the ratios of U^{234}/U^{238}, Ra/MsTh, and Io/Th. (R.V.J.)

HEALTH AND SAFETY

8534 (AD-401687) RADIOLOGICAL MONITORING: CONCEPTS AND SYSTEMS. Richard B. Bothun and Richard K. Laurino (Stanford Research Inst., Menlo Park, Calif.). Feb. 1963. 180p.

Guidelines for design of radiological monitoring systems were developed from an analysis of the radiological information requirements over time of the principal organizational elements of civil defense, with respect to the emergency and recovery phases. Constraints on the design criteria of both fixed and mobile systems were defined as indicated by the information which they must provide. Fixed monitoring systems were studied with respect to station spacing, intensity reporting levels, accuray of equipment, and related design specifications. The operational constraints and the techniques of deployment of mobile systems were also considered. Specifications of instrument accuracy were developed from considerations of both the accuracy with which dose can be related to the biological effect and the precision of radiological information required to support civil defense operations. The functions of monitoring instruments within shelters were reviewed, and their requirements for accuracy and range were developed. Initial investment and annual operating costs were estimated for selected systems. (auth)

8535 (AD-426044) VULNERABILITY OF WATER SYSTEMS. A STUDY OF THE VULNERABILITY OF WATER SYSTEMS TO RADIOACTIVE FALLOUT AND METHODS OF INCREASING THEIR SURVIVABILITY. (Panero (Guy B.) Engineers, New York). Oct. 22, 1963. Contract OCD-OS-62-61. 290p.

The vulnerability of water supply systems to contamination by fallout is reviewed. Various means of protecting them as well as alternate emergency operating procedures are considered. The effect of numerous physical parameters and the significance of certain attributes of system components are discussed. Alternate sources of potable water are reviewed and estimates made of their potential quantities. The results of this phase are compared with a spot check made on an arbitrarily selected city. A comparison was also made of Civil Defense procedures of vital facilities in order to determine preferred methods of protection, and the relationship and application of these methods to water supply systems. (auth)

8536 (AHSB(S)R-57) DECONTAMINATION. A SYMPOSIUM HELD AT RISLEY ON MARCH 20, 1963. A. Cook, ed. (United Kingdom Atomic Energy Authority, Authority Health and Safety Branch, Risley, Lancs, England). 1963. 73p.

Five papers delivered at a symposium on decontamination are presented. Separate abstracts were prepared for each paper. (M.C.G.)

For abstracts of individual papers see: 8537, 8538, 8539, 8540, and 8541.

8537 (AHSB(S)R-57(p.1-14)) DECONTAMINABLE SURFACES. H. Wells (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

Criteria for selecting surface finishes or materials that will resist contamination and/or be easily decontaminated are listed. The role of polymeric materials in contamination control is emphasized. Environmental conditions to which materials and surfaces are exposed are described. The types of contamination and the nature of decontaminating reagents are discussed. The properties of some basic polymers, their method of application, and their relative resistance to contamination and radiation are described. Uses of polymers as surface coatings, flooring materials, structural materials, plastic coatings, protective clothing, and pipelines are illustrated. (M.C.G.)

8538 (AHSB(S)R-57(p.15-26)) METHODS OF ASSESSING DECONTAMINABLE SURFACES. W. J. Colclough (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, Eng and).

The scope of the problem of assessing decontaminable surfaces is discussed. Surface chemistry, resistance of surface to reagents used for decontamination, and processes involved in contamination are considered. Contamination of both metallic surfaces and polymeric materials are discussed. Methods of testing materials are described. Built detergents and complexing agents were studied as decontaminating agents. Examples of tests are described. (M.C.G.)

8539 (AHSB(S)R-57(p.27-40)) THE "DETEX" TECHNIQUE OF DECONTAMINATION. A. Catherall and B. Ariss (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England).

For removal of particulate contamination from areas difficult of access, a strippable film type of decontaminant based on prevulcanized rubber latex was developed. The efficiency of latex was improved by incorporating a complexing detergent composition giving DETEX (detergent-latex). DETEX was found to be most effective when brushed or rubbed on the contaminated surfaces. It may be stripped from the surfaces in a continuous, flexible film. Examples of use are described. (M.C.G.)

8540 (AHSB(S)R-57(p.41-9)) EXPERIENCE IN DESIGN AND OPERATION OF DECONTAMINATION FACILITIES AT A.E.R.E. G. W. Clare (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England).

The decontamination service at Harwell is discussed. Topics covered include: historical development, the decontamination center, personnel, and mobile equipment. (M.C.G.)

8541 (AHSB(S)R-57(p.50-60)) EXPERIENCE IN DESIGN AND OPERATION OF DECONTAMINATION FACILITIES AT DOUNREAY. W. S. Murdoch (United Kingdom Atomic Energy Authority. Reactor Group, Dounreay, Caithness, Scotland).

Decontamination facilities at Dounreay are described. Topics covered include: facility, drainage, ventilation, special equipment, buffing machine, monitoring equipment, the high-alpha room, work study, main items for decontamination, glove-box maintenance, methods of decontamination, and philosophy of decontamination. (M.C.G.)

8542 (AHSB(S)R-59) RECOMMENDATIONS ON THE SAFE HANDLING OF ZIRCONIUM METAL AND ZIRCONIUM ALLOYS. G. H. Bulmer and A. Quinton (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England). 1963. 51p.

This report amplifies recommendations contained in

R.S.P.P. No. 20 on the safe handling of zirconium metal and zirconium alloys. Following a summary of the physical, chemical, and toxic properties of zirconium, the design features necessary to ensure an adequate safety standard in the construction and installation of plant in process areas, laboratories, and stores are given. Where appropriate, statutory and non-statutory regulations are quoted and used as a framework for specifying operational safety requirements for both normal and accident conditions. The special conditions applicable to the storage and disposal of unirradiated and irradiated zirconium are given in respect of the several forms of waste likely to be met with and the report concludes with recommendations on transport and containers. (auth)

8543 (BNL-7522) THE USE OF ACTIVATED-CHARCOAL IODINE MONITORS DURING AND FOLLOWING A RELEASE OF FISSION PRODUCT IODINES. Charles F. Foelix and L. Gemmell (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 9p. (CONF-255-11)

From 8th Air Cleaning Seminar, Oak Ridge, Tenn., Oct. 1963.

The system of iodine monitoring in use at BNL has proved to be a satisfactory means of measuring the release of I^{131} to the environment under emergency conditions. Although the cooling air effluent is monitored by other means, which indicated that something had been released, only the system using activated charcoal traps and gamma spectrum analysis could reliably indicate that a release of equilibrium fission product iodines had occurred and accurately measure the amount released. Other media tested by BNL and others do not have as consistently high collection efficiency as the charcoal traps. The system was also useful in locating the defective fuel elements and in explaining the behavior of iodine within the reactor structure. (auth)

8544 (BNL-7581) MONITORING THE COOLING AIR EFFLUENT FROM THE BROOKHAVEN GRAPHITE RESEARCH REACTOR AT THE POINT OF RELEASE AND IN THE ENVIRONMENT. Charles F. Foelix and Andrew P. Hull (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 15p. (CONF-337-3)

From International Conference on Radioactive Pollution of Gaseous Media, Saclay, France, Nov. 1963.

The facilities for monitoring the particulate activity, Ar^{41}, and I^{131} in the air effluent and the environment of the BGRR are described. The performance of the facilities under emergency conditions is studied for the release incident of Sept. 10 to 13, 1962; it is seen that the I^{131} release, but not the particulate activity release, provided warning. (D.L.C.)

8545 (HW-78395) EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD, APRIL–JUNE 1963. R. H. Wilson, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 16, 1963. Contract AT(45-1)-1350. 39p.

Comprehensive surveillance of the occurrence of radioactive materials in air, water, and foodstuffs was continued in the vicinity of the Hanford plant. Gross beta activity in air during the second quarter of 1963 remained at levels persisting since September 1962 with the exception of a temporary small increase in May from increased deposition of world-wide fallout expected each spring. The average concentrations of I^{131} in milk from farms in the neighborhood of the Hanford plant was about 8 picocuries per liter, and the maximum in an individual sample was 84 picocuries per liter. This represents an increase from the first quarter which was probably due to increased grazing on open pasture. Natural background radiation, with some contribution from world-wide fallout continued to be the primary source of environmental exposure for most people in the Hanford environs. Cooling water from the reactors, which is discharged to the Columbia River, continued to be the low level waste with the greatest potential for contributing to the radiation exposure of persons in the plant environs. For the twelve month period ending June 1963, the estimated dose to the GI tract for persons drinking Pasco sanitary water was about 2% of the applicable limit recommended by the National Committee on Radiation Protection and Measurements (NCRP). Residents of Kennewick using Columbia River water received about one-third as much exposure. In May 1963, a fuel element failute released some fission products into the reactor cooling water and subsequently into the river that was distinguishable at Pasco as a single event. The potential dose to the thyroid of a small child consuming one liter of water during the period of maximum concentration was approximately 10 mrems. The dose to other organs was negligible. Radiophosphorus concentrations measured in whitefish caught between Ringold and Richland continued to be within the expected range based on previous years results. Locally caught fish continued to be the major source of radioisotopes for the few persons who eat them in quantity. Summing of exposures from various sources in a manner that tends to maximize the total dose to an individual leads to estimates of about 10% of the appropriate NCRP limit for the GI tract, about 15% of the FRC guide for the total body, 30% of the FRC guide for a child's thyroid, and about 30% of the NCRP maximum permissible rate of intake for bone seeking radionuclides. (auth)

8546 (HW-SA-3285) RADIATION EMERGENCIES: TYPES AND MECHANISMS. Carl M. Unruh (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 1963. Contract AT(45-1)-1350. 16p. (CONF-277-1)

From Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, Dec. 1963.

Radiation emergency planning is discussed for emergencies resulting from the loss of control of radioactive materials such as spills of radioactive materials, fires, explosions, vehicular accidents, and energized equipment. It is pointed out that the extent and involvement in severity and type of radiation exposure, types and number of people exposed, interaction with the public domain, and the duration of each radiation emergency is a function of the source of the radiation and the mechanics of the accident. Each possible course of an accident requires careful examination to assure that emergency planning and the implementation of emergency plans will be effective and timely. (C.H.)

8547 (IDO-12028) STANDARD HEALTH & SAFETY REQUIREMENTS. ID Manual Appendix 0500-1. [D. H. Dierk, ed. and comp.] (Idaho Operations Office. Health and Safety Div., AEC.). [Sept. 1963]. 284p.

Standard health and safety requirements are presented for the National Reactor Testing Station. The guide compiles into one reference the codes and standards established in the AEC Manual and also incorporates state-wide codes that are applicable. All phases of industrial hygiene, fire prevention and protection, industrial safety, and health physics are included. Nuclear reactor safety is not included. (C.H.)

8548 (NYO-2740-1(p.31-53)) MEASUREMENTS OF MICROSCOPIC DISTRIBUTION OF RADIATION ENERGY. (Columbia Univ., New York. Radiological Research Lab.).

Results are reported from a study of the distribution of absorbed dose in terms of the parameter Y for 14.7-Mev monoenergetic neutrons. Results indicated a very low γ yield. The distribution of the total dose in Y was calculated from pulse height spectra with the aid of an IBM 7090 computer. The counting system used is described. The development of computer methods for use in the correlation of dose-effect curves with energy density distribution is discussed. The design of spherical proportional counters with tissue equivalent plastic walls is reported. (C.H.)

8549 (RT/PROT(63)-4) RAPPORTO DI ATTIVITA PER GLI ANNI 1960 E 1961 DELLA SEZIONE DI FISICA SANITARIA DEL C.S.N. DELLA CASACCIA. (Annual Report on the Radioactivity Collected by the Health Physics Service of the C.S.N. Casaccia During 1960 and 1961). S. Tagliati (Italy. Comitato Nazionale per l'Energia Nucleare, Casaccia). July 1963. 61p.

Meteorological data and the results of measurements of environmental radioactivity by the Health Physics Service of the Center for Nuclear Studies, Casaccia, C.N.E.N., during 1960 and 1961 are presented. Data about the radiation doses absorbed by people employed in the Center during the same period are included. Instruments used for radiological protection and the main performances of the Health Physics Service are described. (auth)

8550 (SC-4973(RR)) HEALTH PHYSICS ASPECTS OF OPERATION ROLLER COASTER. William D. Burnett, Harold L. Rarrick, and George E. Tucker, Jr. (Sandia Corp., Albuquerque, N. Mex.). 1963. Contract [AT(29-1)-789]. 38p.

The radiological safety problems related to the joint AEC-DOD-UK research program, Roller Coaster, for the evaluation of the storage, handling, and transportation criteria of plutonium-bearing weapons and to the post-test cleanup are discussed. The program included four experimental detonations: Double Tracks, in which the biological hazard of scattered plutonium was investigated; Clean Slates One, Two, and Three, in which the scavenging effect of earth covering of storage structures was evaluated. (auth)

8551 (SC-DC-3553) PROCEEDINGS OF AEROSPACE NUCLEAR SAFETY, OCTOBER 1-4, 1963, ALBUQUERQUE, NEW MEXICO. R. E. Dunlap, ed. (Sandia Corp., Albuquerque, N. Mex.). Contract AT(29-1)-789. 366p.

Separate abstracts were prepared for 18 of the 28 papers presented; 8 were previously abstracted in NSA. Topics covered include safety programs and philosophy, nuclear safety aspects of SNAP design and of propulsion reactor design, environmental factors, and re-entry and postmission disposal. (R.E.U.)

For abstracts of individual papers see: 8062, 8517, 8552, 8553, 8554, 8555, 8556, 8557, 8558, 8908, 9069, 9619, 9620, 9715, 9716, 9717, 9718, and 9719.

8552 (SC-DC-3553(p.9-16)) AEROSPACE NUCLEAR SAFETY— LESSONS FROM CIVILIAN AND MILITARY REACTOR EXPERIENCE. James T. Ramey (Atomic Energy Commission, Washington, D. C.).

A review is presented of operating safety experience with civilian and military reactors and the application of this information to nuclear aerospace systems. The necessity of interagency exchange of information is emphasized. (R.E.U.)

8553 (SC-DC-3553(p.19-21)) SAFETY IN SCIENCE. N. E. Bradbury (Los Alamos Scientific Lab., N. Mex.).

The hazards and safeties generated by science are discussed historically. The balance between insufficient and over-sufficient safety considerations is emphasized. (R.E.U.)

8554 (SC-DC-3553(p.33-7)) THE NASA AEROSPACE NUCLEAR SAFETY PHILOSOPHY. H. B. Finger (Space Nuclear Propulsion Office, AEC/NASA).

The NASA safety philosophy is discussed. Emphasis is placed on the development of reliable nuclear systems and the countermeasures necessary to maintain this degree of safety. (R.E.U.)

8555 (SC-DC-3553(p.47-51)) USAF AEROSPACE NUCLEAR SAFETY PROGRAM AND PHILOSOPHY. C. B. Stewart ([Sandia Corp., Albuquerque, N. Mex.]).

The U. S. Air Force philosophy of nuclear safety is discussed. Emphasis is placed on safety studies and the safety responsibilities delegated to all levels of command. (R.E.U.)

8556 (SC-DC-3553(p.255-8)) OFF-SITE RADIOLOGICAL MONITORING PROCEDURES FOR MISSILE TEST RANGES. M. W. Carter, R. D. Coleman, and D. J. Nelson, Jr. (Public Health Service, Washington, D. C.).

The objectives of the Off-Site Radiological Safety Program of the Public Health Service are summarized. The surveillance, liaison, and emergency capabilities of the program, as initiated at the Atlantic and Pacific Missile Ranges, are described. (R.E.U.)

8557 (SC-DC-3553(p.351-60)) SOURCE TERM PROGRAM— AN INTEGRATED TREATMENT OF RE-ENTRY PROBLEMS. H. I. Kraig and J. M. Bridges (Westinghouse Electric Corp. Astronuclear Lab., Pittsburgh).

An integrated calculational approach to determination of the ground hazard from reactor material re-entry, by a program that will accept flight information and yield required information on fragment activity as a function of time, is reported. Data are given for $\frac{1}{64}$-in. particles from different destruct altitudes and conditions. Conclusions on optimum reactor orbits and start modes are given. (R.E.U.)

8558 (SC-DC-3553(p.361-6)) THE AIR FORCE NUCLEAR WEAPON SAFETY PROGRAM. C. B. Stewart ([Sandia Corp., Albuquerque, N. Mex.]).

The major parts of the program of nuclear weapon accident prevention of the USAF are described. (R.E.U.)

8559 (AEC-tr-6268) RADIATION DANGERS FROM CESIUM-137. A. Nelson and B. Carlquist. Translated for Argonne National Lab., Ill., from Svenska Lakartidn., 55: 608-15(1958). 6p.

Radiation hazards from the internal deposition of Cs^{137} in man are reviewed. Data are summarized from studies of Cs metabolism in man. (C.H.)

8560 CONTROL OF BERYLLIUM FIRE HAZARDS IN A FIRE TEST SERIES. Robert J. Everett and Roy O. Mills (Sandia Corp., Albuquerque, N. Mex.). Am. Ind. Hyg. Assoc. J., 24: 584-7(Nov.-Dec. 1963). (TID-18082; SCDC-3092)

As part of the SNAP-10A (Space Nuclear Auxiliary Power) project, beryllium hazards were measured in four controlled fires. Over 125 air samples and swipe samples were taken during the tests; only eight samples showed concentrations of Be above the minimum detectable level. Controls and procedures described insured safe test conditions. Areas needing further study are noted. (auth)

8561 STANDARDIZATION OF γ DETECTORS FOR MEASUREMENT OF THE CONTAMINATION OF SOIL SURFACES BY MEANS OF A POINT RADIATION SOURCE. W. M. Pusch (Philips GmbH, Vienna). Atomkernenergie, 8: 448-52(Dec. 1963). (In German)

Following a reactor accident the soil surface contamination must be determined. When using a Geiger-Mueller counter (or an ionization chamber) for this purpose, the counting equipment should be calibrated, which is not possible directly. But the calibration can be executed in the same way as suggested for the calibration of counting tubes for measuring the contamination of the atmosphere. The calculated flux, caused by contamination of the soil surface in the point of interest, was equalled to the flux caused by a standard point source. The contamination, which has the same counting rate (because of the proportionality of flux and counting rate) as the point source, the counting rate of which can be measured easily, can therefore be determined. As soon as the connection between expected counting rate and contamination of the surface is known for a certain amount of specific activity concentration, it is known for any other, too, because of the proportionality of both functions. The influence of back scattering on the soil surface was estimated. (auth)

8562 CLEANING OF RADIOACTIVE CONTAMINATED OCCUPATIONAL CLOTHING. G. Siewert and Th. Schikora. Kernenergie, 6: 595-607(Nov. 1963). (In German)

The soiling and contamination of work clothing and ways of removing this contamination are discussed. Means of disinfection, washing tests with radioactive-contaminated cotton clothing, construction of the laundry, and cleaning protective clothing of plastic and other materials with the help of washing methods and polyphosphates are described. (M.C.G.)

8563 NATURAL AND FISSION-PRODUCED RADIOACTIVITY IN FOUR INDIANA SOILS. Ilhan Akalan and Joe L. White (Purdue Univ., Lafayette, Ind.). Proc. Indiana Acad. Sci., 72: 325-9(1962).

Continued testing of nuclear weapons and increasing developments in reactors for use in power production have caused growing concern about the levels of fission-produced radioactivity in the earth's surface. In order to establish reference points for the levels of natural and fission-produced radioactivity in Indiana, bulk samples of the 0 to 6" layer of four well-characterized soils were collected for determination of gamma activities. Periodic checking of samples from these sites will provide information on the build-up of radioactivity. Specific isotope analyses are given. (auth)

8564 FILTRATION OF RADIOACTIVE PARTICULATES. S. E. Smith (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 449-75(1963).

The removal of solid particulate radioactive matter from air and other gases in areas where health hazards might form and from reactor cooling systems is discussed. The nature of the aerosols of concern is discussed. The theory of filter action and types of filter media as well as equipment for removing aerosols by electrostatic means, inertial separation, and particle impaction and enlargement are discussed. Some applicable filtration systems are discussed. (R.E.U.)

8565 THE PARTICULATE MATERIAL FORMED BY THE OXIDATION OF PLUTONIUM. K. Stewart (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 535-79(1963).

The particulate material formed in the oxidation of plutonium is discussed because of its biomedical importance as an accident-produced hazard to inhalation. Lung retention is considered. Experimental reports include oxidation at room temperature in air, at the surface of a liquid metal, and at the surface of a solid metal at 120°C. The methods for determining the size distribution of particles are discussed. (R.E.U.)

8566 INVESTIGATIONS FOR RADIATION PROTECTION MEASUREMENTS FOR MIXED RADIATION. II. THE NUCLEAR TRACE EMULSION AS MEASURING APPARATUS FOR PERSONNEL DOSIMETRY. Hans Schreiber and Wolfgang Peters (Versuchs- und Ausbildungsstätte für Strahlenschutz, Neuherberg, Ger. and Flugwissenschaftlichen Forschungsanstalt e.V., Munich). Strahlentherapie, 122: 542-53(Dec. 1963). (In German)

The best method available for dosimetry of neutrons is considered the use of nuclear emulsions. This is especially true for mixed radiation. For the trace counting method a relationship between the measurement of the dose in rem units and the determination of the neutron flux density can be established according to the investigations of Snyder and Neufeld. In the case of fast neutrons the traces of the recoil protons are counted. The limitations of this method with regard to their dependence on the neutron energy are discussed. Slow neutrons are absorbed in B or Li nuclei and the subsequent α traces are counted. The borated Agfa K3-emulsion was especially investigated. A modified film dosimeter (badge type) is suggested, which permits an observation with respect to fast and slow neutrons as well as γ rays. (auth)

8567 ZASHCHITA OT RADIOAKTIVNYKH OSADKOV. (Protection Against Fallout). R. V. Petrov, V. N. Pravetskii, Yu. S. Stepanov, and M. I. Shal'nov. Moscow, Medgiz, 1963. 188p.

Data are given on fallout from nuclear and thermonuclear explosions, and measures for protecting against fallout are discussed. Radiation dose nomograms are included. Descriptions are given of dosimetric and monitoring equipment, decontamination measures, and characteristics of fallout nuclei. (R.V.J.)

8568 MEDICAL SUPERVISION OF WORKERS EXPOSED TO IONIZING RADIATIONS. Proceedings of the International Symposium Held in Stresa-Ispra (Italy), May 2-5, 1961. (European Atomic Energy Community). Sept. 1963. 746p. (EUR-421)

In French, German, Italian, Dutch, and English.

Twenty articles are included; separate abstracts were prepared for 19. One article on international controls in the field of medical action was previously abstracted in NSA. (P.C.H.)

For abstracts of individual papers see: 8097, 8223, 8569, 8570, 8571, 8572, 8573, 8574, 8575, 8576, 8577, 8578, 8579, 8580, 8581, 8582, 8583, 8584, and 8585.

8569 CRITERIA APPLIED BY PHYSICIANS AT THE TIME OF EMPLOYMENT EXAMINATIONS FOR WORKERS IN NUCLEAR INSTALLATIONS. Joseph A. Quigley (National Lead Co. of Ohio, Cincinnati). p.57-73 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

A modern occupational medical program is discussed and evaluated. The examining program, diagnostic and therapy program, pre-placement examinations and criteria, findings at physical examination, and laboratory findings are discussed. Clinical laboratory procedures are outlined. (P.C.H.)

8570 MEDICAL STANDARDS FOR RADIATION WORKERS. T. E. Graham (United Kingdom Atomic Energy Authority, Windscale, Sellafield, Cumb., Eng.). p.75-100; 447-63 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

Criteria upon which acceptance or rejection for jobs as radiation workers are based are discussed. Reasons for rejections in certain cases are explained. (P.C.H.)

8571 BLOOD COUNTS AND RADIATION WORK. R. L. Dobson (World Health Organization, Geneva). p.183-7 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The value of blood examinations in medical supervision of radiation workers is discussed and evaluated. (P.C.H.)

8572 ORGANISATION OF MEDICAL SUPERVISION IN NUCLEAR INDUSTRIES IN THE UNITED KINGDOM. K. P. Duncan (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). p.297-308 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The system of medical supervision that is practiced in the United Kingdom Atomic Energy Authority is explained and the approach in the UK to the medical aspects of protection of workers in the nuclear industries is illustrated. Legislation is also discussed. (P.C.H.)

8573 ORGANISATION OF MEDICAL CONTROL SERVICES IN NUCLEAR INSTALLATIONS FOR WHICH THE AEC IS RESPONSIBLE. T. S. Ely (Office of Health and Safety, AEC). p.309-14 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The organization of medical control services in nuclear installations in the United States is discussed. It is stressed that health protection in nuclear installations is a team job requiring the cooperation of several different specialties. (P.C.H.)

8574 GENERAL PRINCIPLES FOR MEDICAL SUPERVISION OF WORKERS. H. Holthusen (Universität, Hamburg). p.427-41 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The organization of medical supervision for radiation workers in nuclear installations is discussed. The history of medical supervision in the industry is also discussed. Certain rulings on medical supervision are stated and evaluated. (P.C.H.)

8575 THE PROBLEM OF PRE-EMPLOYMENT PSYCHOLOGICAL CRITERIA. P. Sivadon and A. Fernandez. p.465-86 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

Psychological factors involved in working in nuclear industry are discussed. The value of education and information at the various stages in the organization of the work, and also, from the angle of preventive measures, the importance of training in safety procedures is stressed. (P.C.H.)

8576 PRACTICAL VALUE OF BLOOD CHECKS FOR THE SUPERVISION OF PERSONNEL EXPOSED TO IONIZING RADIATIONS. P. Lambin (Université, Louvain, Belg.). p.491-509 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The anomalies that can be determined by blood checks are discussed, and the practical value of such examinations are evaluated. It is stressed that the influence exerted by blood examinations is essentially indirect: the discovery of anomalies acts as a stimulus to the improvement of technological protection and personal discipline. (P.C.H.)

8577 STATISTICAL EVALUATION CRITERIA FOR INDIVIDUAL HEMATOLOGICAL EXAMINATION. C. Polvani (Comitato Nazionale per l'Energia Nucleare, Rome) and G. A. Maccacaro. p.511-40 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

Statistical criteria for hematological examinations for the collection and processing of data representing the conditions of normality as existing in a given demographic area and for the acceptance or rejection of single individuals from the range of normality are discussed. Sources of variability are also considered. (P.C.H.)

8578 SOME HAEMATOLOGICAL AND CLINICAL ASPECTS OF IRRADIATION PROTECTION WORK. J. Becker (Czerny Hospital, Heidelberg). p.541-6 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The effects of radiation on the blood (irradiation hematology) in relation to radiation protection is discussed. Hematology questions involved in bringing into being an effective system of radiation protection are considered. (P.C.H.)

8579 THE VALUE OF BLOOD CHECKS. J. Spaander (National Inst. of Public Health, Utrecht). p.549-75 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The value of and methods for making blood tests are discussed. Discrepancies that are liable to occur in the results of the usual types of blood tests when not carried out under strictly standardized conditions are pointed out. It was concluded that the standard cyan-hemoglobin method, applied together with a standard cyan-hemoglobin preparation, makes it possible to obtain mutually comparable and only slightly divergent results. (P.C.H.)

8580 STATISTICAL STUDY OF THE HEMOGRAMS OF THE STAFF OF A NUCLEAR POWER PLANT BEFORE DIVERGENCE. M. Delpla (Dept. for Protection Against Irradiation, E.D.F., Paris), R. Nussbaum, and P. Funel. p.577-612 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

Out of a total of approximately 150 workers examined prior to being assigned to the Chinon Nuclear Power Plant, one hundred or so were made the subjects of a follow-up study (in the form of quarterly examinations) without being exposed to ionizing radiations, while some hundred workers were examined only once. A statistical study of the hemograms obtained showed that the emotional stress caused by the blood-collecting procedure, especially whenever acceptance is made conditional upon the occupational physician's decision based on the result of the test, distorts the results obtained for all the varieties of blood cells: to a considerable extent in the case of polynucleated neutrophiles, leading to an increase in them; in a very troublesome way for the lymphocytes, the number of which decreases slightly. It follows that due consideration should be given to the emotional factor in the interpretation of every individual hemogram prepared either in the course of a systematic check or as the result of an accident. It was concluded that this factor should be taken into account when laying down adequate fitness standards. (auth)

8581 ESTABLISHING THE NUCLEAR ENERGY WORKER'S MEDICAL RECORD, THE INFORMATION IT GIVES, AND THE CONCLUSIONS TO BE DRAWN FROM IT. L. F. Vidal (Commissariat à l'Energie Atomique,

Saclay, France). p.681-2 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The value of the medical record of nuclear energy workers is discussed. (P.C.H.)

8582 THE PLACE OF DOSIMETRY IN THE ORGANIZATION OF HEALTH CONTROL SERVICES. P. Pellerin and J. Chanteur (Ministry of Public Health, Paris). p.683-5 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The use of radiation dosimetry for workers occupationally exposed outside nuclear centers is discussed. Only external radiation is considered. It was concluded that individual dosimetry, in spite of personal variations, constitutes an alert system that enables inadequacies to be detected in the protection of installations. (P.C.H.)

8583 MONITORING A CASE OF INTERNAL CONTAMINATION BY POLONIUM 210. L. Jeanmaire (Commissariat à l'Energie Atomique, Saclay, France and Nuclear Research Centre, Fontenay-aux-Roses, France). p.687-708 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The results of medical examinations made on a person who accidentally placed both hands on a Po source are reported. It was estimated that total irradiation of the subject was at most 5 rems. Data on blood, urine, and plasma are tabulated. (P.C.H.)

8584 ATTITUDE OF HEALTH INSPECTION SERVICES TO CASES OF OVER-EXPOSURE. H. Jammet (Commissariat à l'Energie Atomique, Saclay, France and Centre for Nuclear Studies, Fontenay-aux-Roses, France). p.711-22 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

The attitude adopted by health inspection authorities in cases of over-exposure to radiations is discussed. The line of over-exposure is first considered and then the line of conduct to be adopted. A few suggestions on the principles that should govern the elaboration of a relevant doctrine are given. (P.C.H.)

8585 EMERGENCY MANPOWER POOL. E. M. Renton (Atomic Energy of Canada, Ltd., Chalk River, Ont.). p.379-402; 723-37 of "Medical Supervision of Workers Exposed to Ionizing Radiations." [Brussels], Euratom, 1963.

An emergency manpower rating system for nuclear incidents is outlined. The plan was set up in an attempt to integrate on tabulating cards all medical information, personal data, blood pictures, internal and external radiation exposures. (P.C.H.)

8586 RADIATION HAZARDS IN THE NEIGHBOURHOOD OF HOSPITALS AND THEIR ASSESSMENT. S. B. Osborn (King's Coll. Hospital, London). 6p. (CONF-365-26)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Radiation hazards in hospitals resulting from the accidental release of radioactive materials are surveyed. It is concluded that the greatest hazards are likely to involve Co^{60} and Cs^{137} used in beam therapy units and Ra^{226} used in needles and tubes. It is pointed out that γ sources are housed in heavy protective heads with built-in safety devices and are located in fire-proof rooms. Radium needles are normally stored inside Pb protection. However, in the event of a catastrophic accident such as a fire, explosion, or the crashing of a plane, it is possible that the Ra may become liberated and result in large-scale contamination of the surrounding areas. It is pointed out that α sensitive monitors are required for use in clean-up operations. It is concluded that the greatest radiation hazard to the population is from the irradiation of patients during medical radiology. (C.H.)

8587 ENVIRONMENTAL SURVEYS AROUND RESEARCH REACTORS. K. Boddy. 12p. (CONF-365-19)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Experience gained from environmental surveys during the commissioning and operation of the 5 Mw MERLIN Reactor and the proposed program for the UTR-100 Scottish Universities Reactor is reported as a guide to the extent and pattern of the environmental surveys required at other sites. (P.C.H.)

8588 ENVIRONMENTAL MONITORING IN THE OPERATION OF A NUCLEAR POWER STATION. B. Emmerson (Central Electricity Generating Board, London). 30p. (CONF-365-13)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The environs monitoring program by the health physics staff at nuclear power plants in England is described. Various tests are described and the specific duties of monitors during burst cartridge detection tests are listed. A typical civil nuclear station health physics staff tree is illustrated. (P.C.H.)

8589 RADIOLOGICAL CONTROL IN UNIVERSITY LABORATORIES. J. C. Collins (Univ. of Manchester, Eng.). 11p. (CONF-365-10)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

A program for radiation safety in university laboratories in England is described. A radiation protection officer who acts as adviser to the separate departments was appointed. The radiation protection officer and his staff are responsible for the surveillance of health physics throughout the university and gives instruction in health physics appropriate to the work of the different laboratories. Laboratory gradings and surveys are also discussed. (P.C.H.)

8590 CURRENT PRACTICE IN THE SURVEY OF THE WORKING ENVIRONMENT AT THE WANTAGE RESEARCH LABORATORY. G. W. Cox (United Kingdom Atomic Energy Authority, Wantage, Berks, Eng.). 9p. (CONF-365-11)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The use of large sealed and small sealed and unsealed sources at the Wantage Research Laboratory is discussed. The health physics program for monitoring at the laboratory is given in detail. The amount of environmental monitoring required at Wantage is kept to a minimum by careful planning at the initial stages of a program of work, due consideration being given to such matters as good design, provision of adequate shielding, use of minimum quantities of radioactive material consistent with requirements and the use, wherever possible, of radioisotopes with short half lives so that any residual activity decays quickly. (P.C.H.)

8591 CURRENT PRACTICE IN THE SURVEY OF WORKING ENVIRONMENTS AT A.E.E. WINFRITH. J. J. Clifton, J. Croft, and R. S. Iles (United Kingdom Atomic Energy Authority, Winfrith, Dorset, Eng.). 7p. (CONF-365-12)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Some of the more important facets of the survey practice

at Winfrith are outlined. It is stressed that the program is essentially in the nature of an experiment. As such it is planned by scientific staff and is continuously analyzed and modified in the light of data obtained. The actual survey measurements are carried out by a small number of highly trained non-professional staff. Also the survey procedures are scrutinized critically and continuously by the professional health physics staff. (P.C.H.)

8592 PROBLEMS ASSOCIATED WITH THE USING AND HANDLING OF ARTIFICIAL RADIOACTIVE MATERIALS USED IN INDUSTRIAL RADIOGRAPHIC APPLICATIONS. George S. Barlow, Jr. (New Port News Shipbuilding and Dry Dock Co., Va.). 10p. (CONF-361-1)

From 1963 Joint IEEE ASME Materials Handling Conference, Fort Monroe, Va., Oct. 1963.

Problems associated with the handling, packaging, and storage of radioactive materials are listed and discussed. Rules handed down by the AEC and ICC are given. (P.C.H.)

8593 GASEOUS EFFLUENT MONITORING AT C.E.G.B. NUCLEAR POWER STATIONS. D. Tattersall (Central Electricity Generating Board, London). 14p. (CONF-365-8)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Stack monitoring at nuclear power stations is discussed. The monitoring of shield cooling air and reactor coolant are considered separately and illustrated by examples from particular stations. Particulate monitoring and gaseous monitoring are described. (M.C.G.)

8594 CONTINUOUS SAMPLING AND MEASUREMENT OF AIRBORNE ACTIVITY. K. E. G. Perry (United Kingdom Atomic Energy Authority, Winfrith, Dorset, Eng.). 33p. (CONF-365-6)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The methods employed for environmental sampling and measurement for both particulate and gaseous airborne contamination are described. A brief description is given of the instruments that are in current operational use for continuously monitoring the air for contamination. A summary is made of new instruments and techniques at present under development. (auth)

8595 REPRESENTATIVENESS OF AIR SAMPLING FOR PARTICULATES. R. J. Sherwood (United Kingdom Atomic Energy Authority, Harwell, Berks, Eng.). 15p. (CONF-365-5)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Air sampling plays an important role in the safe handling of radioactive substances, and is used on a large scale in the Atomic Energy industry to monitor the atmosphere which workers may breathe in factories and laboratories. To sample radioactive particulates the Health Physicist has somewhat uncritically adapted air sampling techniques suitable for chemically toxic dusts. He is fortunate in being able to obtain a fairly rapid and simple numerical indication of conditions, which he may compare with standards recommended by the International Commission on Radiological Protection. A consideration is given of five of the factors that require further consideration if dependence is to be placed on the results obtained. These factors are: 1. The location of the sampler in relation to the worker. 2. The likely presence of single highly active particles on the collecting medium. 3. The tendency to underestimate the average exposure if occasional random samples are taken. 4. The presence of activity on particles which are unlikely to penetrate far into the human respiratory system. 5. The underestimation of α activity due to self-absorption within large active particles. If it is necessary to determine the concentration of airborne activity to which individual workers are exposed, in many situations it can only be undertaken by personal air sampling. Before any significance can be attached to a single air sample, it must be ensured that the sample is representative of a radioactive cloud; that is, the greater part of the activity must stem from a significant number of particles. Samples taken in laboratory areas at A.E.R.E. have frequently shown the predominant presence of one or a few more highly active particles. In a detailed examination of airborne particles in plutonium areas, the activity has been found either in the form of high specific activity particles, probably of plutonium oxide, or as inactive particles which have been wetted in plutonium solution or show the adherence of fine plutonium particles to their surface. There are marked variations from one sample to another in the fraction of the activity likely to be deposited in the unciliated portions of the lungs, and this appears to be independent of the form the particles take. Brief reference is made to possible problems associated with sensitive alarm monitors and with alpha-spectrometric measurements. (auth)

8596 AN ALTERNATIVE TO DISTRICT SURVEY SAMPLING. W. N. Saxby (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). 8p. (CONF-365-25)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The possibility of adverse radiological effects on individuals in the neighborhood of a modern atomic plant in its routine work can be reduced below a significant level by the design of, and the operational procedure in, the plant. Of the methods of checking that the plant is continuing to operate correctly, monitoring at the discharge outlets is the most convenient and economical and the most sensitive procedure, and is the preferred alternative to District Survey sampling, provided that the plant has been suitably designed. This method is sufficiently sensitive for changes leading to increased discharges to be found and for corrections to be made quickly before significant levels are reached in the neighborhood. (auth)

8597 MARINE ENVIRONMENTAL MONITORING IN THE VICINITY OF WINDSCALE. H. Longley and W. L. Templeton (United Kingdom Atomic Energy Authority, Windscale, Cumb, Eng.). 38p. (CONF-365-18)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The extensive environmental monitoring during the last ten years has shown that there has been no systematic increase in the radioactivity levels of concern to man due to the discharges of radioactive liquid waste to the Irish Sea from Windscale. The radiation doses of people who may eat seaweed or fish collected in the area, or who fish in the sea, or bathe from the beaches, can never have reached the maximum permissible values. The ruthenium-106 content of edible seaweed is the most restrictive factor which limits the discharges, but accumulation by the edible seaweed also restricts the permissible discharges of other radionuclides. From the monitoring data for edible seaweed, it is possible to deduce values for the discharges which may produce the derived maximum permissible concentrations on the seaweed, although the accuracy of these estimates will be poor for discharge rates of less than about 500 curies per month. The extended

survey traced the effluent both northwards and southwards from Sellafield towards the Mull of Galloway in the north and towards Anglesey in the south. The concentration of β activity in bottom marine organisms decreases very rapidly in the first 20 miles northwards and southwards from Windscale. Since the maximum permissible concentrations in seaweed, fish, and sea bottom material are not exceeded at Sellafield, no radiological hazard to man is likely to occur in any other part of the north eastern Irish Sea. (auth)

8598 THE MONITORING OF URANIUM AND PLUTONIUM DUST HAZARDS. S. E. Hunt, D. Allenden, K. Boddy, B. Cattle, D. V. Freck, E. D. Taylor, and D. G. Waters (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). 13p. (CONF-365-7)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

A survey of the available literature indicates that the main inhalation hazard arises from particulate matter of diameter between 0.5 micron and 10 micron. Methods of assessing this hazard in the presence of the α activity of thoron and radon daughter products are reviewed. (auth)

8599 ASPECTS OF X-RADIATION MONITORING TECHNIQUES FOR HIGH VOLTAGE ELECTRONIC EQUIPMENT. A. W. Balls. 11p. (CONF-365-15)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

A description is given of some of the less familiar problems encountered in the monitoring of radiation emitted by electrical apparatus, although the better known difficulties, such as the errors arising in the measurement of small beams with large detectors, have also to be kept in mind. It can be seen that the consideration of many factors, helped by an awareness of the possible pitfalls associated with measurements on particular types of apparatus, is essential to ensure that a true assessment of the hazard existing in any set of circumstances is obtained. This is, of course, not really the end of the matter. The problems of protection naturally follow; whether in the test bay to screen the apparatus or the operator; whether adequate screening can be installed without obstructing the operator's view of the apparatus; whether screening will interfere with the performance of the equipment. Without going further into these aspects it may be said, in conclusion, that manufacturers are well aware of the existence of radiation hazards arising from the use of electronic equipment, and are taking all possible steps to ensure the safety of those people who help with the manufacture of the equipment and of those who use it afterwards. (auth)

8600 RADIATION SAFETY PROBLEMS IN A LARGE ELECTRICAL ENGINEERING COMPANY. C. W. Miller (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). 21p. (CONF-365-17)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Some of the problems encountered in supervising safety measures in a large electrical engineering concern are reviewed. Administrative problems due to the range of applications and a dispersion of factories are catered for by a central advisory committee, the members of which each take responsibility for certain groups of factories. The importance of divorcing the operation of safety supervision from that the production administration is stressed, as is also the avoidance of hazards in those problems that are not yet covered by legislation. As regards technical problems which have been met, these range from a Metallurgical Laboratory covered by a Nuclear Site license, through high power particle accelerators and x-ray equipment to small scale tracer laboratories. In addition a number of equipments inevitably produce x-ray outputs although this is not their intended function. Some difficulties encountered in radiation measurements are mentioned and these include the measurement of airborne contamination in the presence of an x-ray background and also the measurement of x-ray leakage in the presence of high power electrical pulses. Some possible weaknesses in present legislation are also mentioned. (auth)

8601 C.E.G.B. DISTRICT SURVEY. H. C. Tresise. 16p. (CONF-365-20)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

A District Survey program is planned around each nuclear power station owned by the Central Electricity Generating Board to provide information on the effect of station operation on the neighborhood and on the background radiation in the area which might be affected by a nuclear emergency. The present pattern of the program (measurement points) is described with Berkeley as a particular example. The results obtained in the District Survey at Berkeley are summarized. (D.L.C.)

8602 RADIOACTIVITY IN AGRICULTURAL PRODUCTS AND ITS ASSESSMENT BY ENVIRONMENTAL SURVEY. R. Scott Russell. 12p. (CONF-365-2)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The basic principles of environmental surveys are discussed, along with the practical aspects of survey procedures. Special attention is given to milk. (P.C.H.)

8603 THE MONITORING OF ARTIFICIAL RADIOACTIVITY IN WATERS ROUND THE BRITISH ISLES. F. Morgan. 22p. (CONF-365-3)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Methods and results of monitoring artificial radioactivity from fallout and waste disposal in waters around British Isles are discussed. Radioisotope concentrations in shellfish, fish, seaweed, and sediments were studied. Trends in monitoring are discussed. (M.C.G.)

8604 THE SURVEY OF WORKING ENVIRONMENTS IN INDUSTRY—R.P.S. EXPERIENCE. M. J. Duggan (Central Electricity Generating Board, London). 12p. (CONF-365-27)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Activities of the Radiological Protection Service (RPS) in surveying working environments in industry are discussed. Surveys in establishments under normal working conditions, surveys of buildings where radiation work has ceased, and the recovery of damaged sources are reviewed. (P.C.H.)

8605 IMPROVEMENTS IN OR RELATING TO TRANSFER SYSTEMS FOR GLOVE BOXES OR LIKE CELLS. Frederick John May and Arnold Stanley Kearney (to United Kingdom Atomic Energy Authority). British Patent 946,477. Jan. 15, 1964. Filed Apr. 25, 1961.

A system was developed for transferring toxic substances and particularly radioactive materials into a glove box or similar cell. A transfer chamber is connected to the glove box and a closure selectively isolates the chamber from the glove box and/or the outer atmosphere. The transfer chamber is provided with an air bleed through the chamber into the glove box. The air bleed is associated with a nonreturn valve and adjusting means are provided outside the chamber to regulate the air bleed. (M.C.G.)

INSTRUMENTATION

General

Refer also to abstract 8484.

8606 (HW-78388(p.7.1-10)) INSTRUMENTATION AND NONDESTRUCTIVE TESTING. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Three gamma effluent monitors covering the gamma concentration range from 10^{-5} to 10^{-1} μC/ml were installed in the Plutonium Recycle Test Reactor. The neutron temperature, spectral parameters, and neutron flux were determined in a water-cooled irradiation facility at the KE-Reactor by using bare and cadmium-covered cobalt samples. Three prototype B^{11} detectors were fabricated. These detectors use the high-energy beta particles from B^{12} decay to produce an electrical current proportional to the incident neutron flux. Work was resumed on the development of an in-core neutron flux monitor using microwave techniques. A multiparameter eddy-current nondestructive testing device showed good separation of test parameters for three-layered samples. A prototype eddy-current instrument for detecting hydride in Zircaloy-2 reactor process tubes is being developed. A small ultrasonic probe was developed for use in sampling portions of wave fronts 0.007-in. in diameter. A dual-beam crystal was developed to reduce spurious indication of tubing defects formerly encountered with a single-beam transducer. (M.C.G.)

8607 (HW-79222) VARIABLE COINCIDENCE CIRCUIT. J. R. Kosorok (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [Oct. 11, 1963]. Contract AT(45-1)-1350. 13p.

The design and operation of a two-channel transistorized coincidence circuit with four switch selected resolving times of $\frac{1}{4}$, $\frac{1}{2}$, 1, and 2 μsec are described. A variable delay line in each channel allows a signal delay before the coincidence circuit of $\frac{1}{4}$ to $2\frac{3}{4}$ μsec in ten $\frac{1}{4}$ μsec steps. The signal delay is used to bring two signals, one of which is leading the other in time, into time coincidence. (auth)

8608 (IDO-16914) EFFECTS OF TRANSIENT NUCLEAR RADIATION ON TRANSDUCERS AND ELECTRICAL CABLES. F. D. Terry (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Nov. 30, 1963. Contract AT(10-1)-205. 33p.

This series of tests was conducted on behalf of the Spert program to determine the effects of high peak flux, transient nuclear radiation on the performance of various types of transducers and electrical cables. Items included in the tests were ion chambers, thermocouples, flowmeters, velocity and pressure transducers, strain gages, and several types of electrical cables. This report contains a description of the tests and of the performance of all test items in transient nuclear fluxes of up to 1.9×10^{16} nv. (auth)

8609 (LF-13) DATA PROCUREMENT AND PROCESSING FOR THE FISSION PRODUCT INHALATION PROGRAM USING AN AUTOMATIC READ OUT COUNTING SYSTEM. Technical Progress Report. R. M. Goodrich and R. G. Thomas (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). Dec. 1963. Contract AT(29-2)-1013. 25p.

Data processing primarily concerned with studying experimentally the distribution and excretion of inhaled mixed fission products was developed. An automatic read out counting system is described which allows the radioactivity information from the scaling system to be transmitted directly to punch tape and/or typewriter. Additional sample information, such as tissue identification and weight, counting time, experiment number, etc., is preset with thumb-wheel switches into a data input box. Read out of the data input box just precedes scaler read out, the signal for which is given by the end of preset counting time. The punched-tape is converted to cards which are stored until completion of an experiment. At this time the information is used in a program to compute the necessary parameters for final distribution and excretion analysis. When desired, the computer plots the radioactivity data from any given series of tissue or whole body determinations and yields the constants of the least squares equations. Integration of the function may also be performed for dosage determination. (auth)

8610 (NAA-SR-Memo-8807) DESIGN BASIS OF A COLLIMATOR FOR EXAMINING IRRADIATED FUEL AND SODIUM BOND. M. A. Greenfield and R. L. Koontz (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Sept. 12, 1963. Contract AT-11-1-GEN-8. 15p.

Results are presented of a preliminary study of the use of scintillation spectrometry, coupled with a collimator having narrow geometry, to determine the relative burnup along an irradiated fuel rod and the level of the sodium above the fuel rod. Formulas are derived for the counting sensitivity of the system as a function of a number of parameters: radiation history of the fuel rod, percentage of non-volatile fission products released to the sodium from the irradiated fuel, dimensions of the collimating slit, distance between fuel and end of collimator, and speed of scanning. (auth)

8611 (NBL-204(p.29-32)) A MASS SPECTROMETER FILAMENT AND ACCELERATING VOLTAGE PROTECT CIRCUIT FOR USE WITH ION PUMPS. R. J. Hemmer (New Brunswick Lab., AEC, N. J.).

A protect safety circuit was installed in the ion pump circuitry used for mass spectrometers. This was accomplished by adding a meter relay and its associated components to the ion pump power unit. (auth)

8612 (NP-13525) AMPLIFICADOR LINEAL. INFORME NO. 95. (Linear Amplifier. Report. No. 95). José R. Lorenzetti and Santiago F. Pinasco (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1963. 12p.

A modified linear pulse amplifier with only three tubes is described that has the following characteristics: gain = 1000; output pulse voltage, within its linear range = +100 volts; rise time = 0.10 μsec; and decay time = 0.1 μsec with 200 pF at the output. (auth)

8613 (NYO-10723) APPLICATIONS OF ULTRASONIC ENERGY. ULTRASONIC INSTRUMENTATION FOR NUCLEAR APPLICATIONS. BiMonthly Progress Report No. 12, August 1, 1963–September 30, 1963. (Aeroprojects, Inc., West Chester, Penna.). Oct. 1963. Contract AT(30-1)-2910. 9p.

The ultrasonic liquid-level detector was proof-tested in the autoclave at Idaho Falls. These tests indicated a high degree of reliability and reproducibility of measure-

ment. Following this check-out, the instrument was installed in the Borax V reactor for operational use. The range of the ultrasonic void-fraction measurement was extended to 16% voids using an air-in-water simulation. (auth)

8614 (PR-P-59(p.46-64)) ELECTRONICS BRANCH. P. R. Tunnicliffe (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.).

Developments in reactor instrumentation, data analysis equipment, automatic control and recording equipment, micrologic circuits, component procurement and evaluation, and of various circuits and instruments are summarized. Electron emission induced by radiation was also investigated. (D.C.W.)

8615 (RISÖ-38) ANALYSIS OF FAILURE DATA FOR ELECTRONIC EQUIPMENT AT RISO. Aage Jensen, Jens Rasmussen, and P. Timmermann (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Sept. 1963. 23p.

A failure reporting system for electronic equipment is described, and fault data for selected electronic reactor instruments and research equipment are presented. Some average figures are suggested for rough predictions of failures in larger instrument systems. (auth)

8616 HIGH VOLTAGE DEUTERIUM FILLED GRID CONTROLLED RECTIFIERS. B. O. Baker and R. J. Wheldon (General Electric Co. Ltd., Wembley, Eng.). Electron Eng., 36: 24-9(Jan. 1964).

The hot-cathode deuterium-filled grid-controlled rectifier is compared with other hot-cathode discharge devices, and at voltages of 25kv and over, certain advantages are claimed. The factors governing the design of such rectifiers that are discussed include: electrostatic fields, nature, and pressure of gas filling, effect of activated surfaces, and efficiency of the thermionic cathode. Considerable advantage can be obtained by the use of deuterium instead of hydrogen, both in the ease of grid firing and in the ability to hold off high voltages. These design principles were applied in the development of two rectifiers, designated E2746 and E2816 for ratings of 25kv, 350mamp mean current, and 40kv, 3.5amp mean current, respectively. These valves make possible the design of very compact high voltage power supplies that are robust and economic. The principles can be extended to higher voltages by the use of "multiple box" structures, and to higher currents by suitable electrode cooling. (auth)

8617 MASS SPECTROMETER FOR STUDYING ION PROCESSES IN THE GASEOUS PHASE AT HIGH PRESSURES. K. S. Burdin, S. L. Pozharov, D. S. Starodubtsev, and I. G. Chernov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 4, 59-65(1963). (In Russian)

Descriptions are given of a mass spectrometer with a resolving power of ~120. The device was used for studying ions drawn out along an axis from the cathode or anode. Ion yields into post-cathode and post-anode spaces were determined at various pressures. (R.V.J.)

8618 A BLAST WAVE DENSITY GAUGE USING BETA-RADIATION. J. M. Dewey and W. A. Anson (Suffield Experimental Station, Ralston, Alberta, Can.). J. Sci. Instr., 40: 568-72(Dec. 1963).

A gage was designed to determine the gas density in blast waves by recording the attenuation of β rays from erbium-169 using a compact detector unit and transistor amplifier. The output signal is transmitted over several thousand feet of coaxial cable and recorded as an f-m signal on magnetic tape. Voltage and density calibration units are described. The gage was used to study blast waves in the 60 to 5 lb in.$^{-2}$ over-pressure region, and some results are presented. The present accuracy of about ±10% may be improved by using a source of greater activity and by strengthening the mounting system to prevent slight changes of the source-detector geometry. (auth)

8619 INDUSTRIAL APPLICATION OF NEUTRON SCATTERING AND ABSORPTION. I. NEUTRON LEVEL GAUGE. Shigemasa Enomoto and Nobuo Wada (Nagoya Municipal Industrial Research Inst., Japan). Nagoya Kogyo Gijutsu Shikensho Hokoku, 12: 381-4(Aug. 1963). (In Japanese)

The surface level of hydrogeneous material in a steel vessel was measured using a Ra–Be fast neutron source (Ra 4.81 mg) and a B–ZnS(Ag) scintillation counter for slow neutrons. The source and the counter were placed side by side at the same height and facing the vessel containing the material. The contribution of gamma rays from the source was eliminated by the pulse-height discrimination method. The level was remotely determined with an accuracy of about ±1 cm, within 15 cm around the source. The level determination is possible through a wall thickness of up to 4 cm. (auth)

8620 THE CANBERRA HOMOPOLAR GENERATOR LIQUID METAL JET SYSTEM. E. K. Inall (Australian National Univ., Canberra). Nucl. Energy, 14-16(Jan. 1964).

The Canberra homopolar generator, which is designed to deliver a current pulse rising to about 1.5 mamp and falling to zero again in two seconds with an open circuit voltage of 800 v, is described. Two armatures consisting of steel disks rotate at high speeds in a magnetic field, and electric connection is made by means of narrow ring jets of liquid NaK squirted on to the rotor surfaces. The NaK handling plant and contaminant removal are also described. (C.E.S.)

8621 APPARATUS FOR X-RAY MEASUREMENTS AT VERY HIGH PRESSURE. E. A. Perez-Albuerne, K. F. Forsgren, and H. G. Drickamer (Univ. of Illinois, Urbana). Rev. Sci. Instr., 35: 29-33(Jan. 1963).

An apparatus was developed that permits x-ray powder patterns to be obtained to over 500 kilobars pressure. The apparatus is derived in part from a supported tapered piston electrical resistance apparatus, but the x rays are transmitted through a thin layer of LiH with suitable platinum collimation. The pressures are established by measuring the change of lattice parameter of a suitable marker mixed with the sample. These changes are then compared with volume changes obtained in shock wave work. Usual markers used to date include silver, rhodium, and palladium. Typical data for sample pressure versus average applied pressure for these metals are given. Also included is the change in lattice parameter with pressure for CsCl to 500 kilobars. The results are compared with the extrapolation of Bridgman's data. (auth)

8622 GAMMA-RAY CIRCULAR POLARIZATION ANALYZER USING A RAPIDLY ALTERNATING MAGNETIC FIELD. Robert E. Pechacek, Lloyd G. Mann, Stewart D. Bloom, and Richard M. Rodrigues (Univ. of California, Livermore). Rev. Sci. Instr., 35: 58-63(Jan. 1964). (UCRL-7415)

Gamma rays from substances with half lives approaching 0.1 sec can be analyzed using a magnet whose saturated field reverses in 0.4 msec. Laminated magnetic material and transistor circuitry are used to achieve the fast field reversal. The magnet consists of 4-mil Supermendur tape wound on a toroidal core. The high permeability and low

loss of this material permits it to be driven by a single turn at reasonable currents. The circuit uses a low-voltage, high-current power supply, and charging inductors to provide the necessary voltage pulses. These pulses are developed across switches consisting of ten 2N1358 power transistors operated in parallel. The system has operated 2000 h without a failure. (auth)

8623 ENERGY DISTRIBUTION OF IONS FORMED IN THE rf SPARK SOURCE. J. R. Woolston and R. E. Honig (RCA Labs., Princeton, N. J.). Rev. Sci. Instr., 35: 69-74(Jan. 1963).

Utilizing the ion source and electrostatic analyzer of a double-focusing mass spectrograph, the energy distribution of the ions formed by the pulsed r-f vacuum spark was determined for various materials and sparking conditions. Upon emerging from the electrostatic analyzer, the ion beam has a width, in the y direction, which is principally due to its angular divergence α and its energy spread β. By suitably reducing the widths of the defining slits, α can be made negligibly small. The beam width is then a nearly linear function of β alone, and a photoplate, placed just beyond the exit of the electrostatic analyzer, is used to determine the energy distribution of the ions produced in the source. A convenient energy scale is put on the same photoplate by exposing it to thermal ions (energy spread about 0.5 ev) that are accelerated to selected voltages while the deflecting voltage in the electrostatic analyzer is kept constant. A 1 × 2 in. photoplate can be shifted by external means to permit 31 exposures to be made. Thus, many different sparking conditions and electrode materials, together with thermal ion calibrations, could be investigated and compared in a single experiment. At an accelerating voltage of 20 kv, an energy range of more than 3000 ev is recorded. The residual α, set by two 0.001-in. defining slits, permits an energy resolution of 15 ev. The energy distribution of the ions produced by the r-f spark depends strongly on the spark-gap width, the r-f voltage, and the electrode material. The narrowest energy spread possible is obtained with metallic electrodes at small r-f voltages. Only two special cases were found where 90% of the ions were contained in an energy band no more than 500 ev wide. In all other instances, energy spreads are found to range from about 1000 to perhaps 5000 ev, with the mean energy located up to 1300 ev above the accelerating voltage. The fine structure and significance of these distributions is discussed in some detail. (auth)

8624 ADAPTATION OF AN X-RAY DIFFRACTOMETER FOR THIN FILM STUDIES BY TOTAL REFLECTION OF X RAYS. R. L. Mozzi and O. J. Guentert (Raytheon Co., Waltham, Mass.). Rev. Sci. Instr., 35: 75-9(Jan. 1964).

In studying solid surfaces by the total reflection of x rays it is important to use monochromatic radiation with a narrow angular divergence and to employ a mechanism for precisely aligning the surface of the sample relative to the incident beam. An x-ray monochromator, based on the phenomenon of anomalous transmission in nearly perfect germanium crystals, and a sample holder are described that convert a conventional x-ray diffractometer to an x-ray reflectometer without altering its basic design. Procedures for alignment and operation of the reflectometer and a sample measurement of the thickness and density of a thin titanium film are presented. (auth)

8625 OBSERVATION AND IDENTIFICATION OF ION DISSOCIATION PROCESSES OCCURRING IN THE DRIFT TUBE OF A TIME-OF-FLIGHT MASS SPECTROMETER. W. W. Hunt, Jr. (Air Force Cambridge Research Labs., Bedford, Mass.), R. E. Huffman, and K. E. McGee. Rev. Sci. Instr., 35: 82-7(Jan. 1964).

The shifts in ion flight times produced by a flat-top potential barrier applied within the drift tube of a time-of-flight mass spectrometer are defined analytically in terms of the height of the potential barrier. These flight-time shifts are selectively dependent on the mass, charge, and kinetic energy of the ions involved; consequently, they can be used to separate and identify the products of ion dissociation processes occurring in the drift tube. Comparisons of calculated and observed flight-time shifts for the $58^+ \rightarrow 43^+$, 42^+ dissociations in n-butane are used to illustrate the applicability and present limitations of this method of identifying dissociation products. (auth)

8626 TIME-OF-FLIGHT MASS SPECTROMETER ADAPTED FOR STUDYING CHARGE TRANSFER, ION DISSOCIATION, AND PHOTOIONIZATION. W. W. Hunt, Jr. (Air Force Cambridge Research Labs., Bedford, Mass.), R. E. Huffman, J. Saari, G. Wassel, J. F. Betts, E. H. Paufve, W. Wyess, and R. A. Fluegge. Rev. Sci. Instr., 35: 88-95(Jan. 1961).

A time-of-flight mass spectrometer was modified so that the drift tube can be used as a reaction/collision chamber for kinetic studies of charge transfer, ion dissociation, and similar processes; and ions can be produced in the source by either pulsed or continuous electron or photon beams. Variable potential barriers, produced in the drift tube by means of movable screened retarder grid assemblies, permit parent ions and fragment ions to be separated, identified, and measured after reaction times that are selectively variable within the range $7.197 \times 10^{-3}(m/q)^{\frac{1}{2}} \leq t_r \leq 7.053(m/q)^{\frac{1}{2}}$ μsec, where m/q is the mass-to-charge ratio of the parent ions in amu per electron charge. The kinetic energy range is from 100 to 10,000 ev for positive ions and 3000 ev for negative ions. The residence time of ions within the ionizing region can be varied continuously from 0 to 100 μsec. (auth)

8627 USE OF BENT-CRYSTAL MONOCHROMATORS FOR ISOLATION OF α_1 OR α_2. R. E. Scott (Space Technology Labs., Inc., Redondo Beach, Calif.). Rev. Sci. Instr., 35: 118-19(Jan. 1964).

It is shown that for reflection-type quartz bent-crystal monochromators, the penetration aberration is the limiting factor on the monochromator resolution in the case of isolation of the $K\alpha_1$ component of $K\alpha$ x rays, especially for shorter wavelengths. The residual $K\alpha_2$ relative intensity due to this aberration is calculated for Cu and Mo. (R.E.U.)

8628 SIMPLE ELECTRON BOMBARDMENT APPARATUS FOR EVAPORATING BORON. K. L. Erdman, D. Axen, J. R. MacDonald, and L. P. Robertson (Univ. of British Columbia, Vancouver). Rev. Sci. Instr., 35: 122-3 (Jan. 1964).

An electron bombardment apparatus is described that is used in preparing evaporated films of high-resistivity materials. Temperatures greater than 2500°C were obtained. (R.E.U.)

8629 IMPROVED HIGH VOLTAGE SPARK GAP, REQUIRING ZERO ENERGY TO TRIGGER. O. E. Smith (Sandia Lab., Albuquerque, N. Mex.). Rev. Sci. Instr., 35: 134(Jan. 1964). (TID-18943)

A switching circuit for a three-element spark gap is described that is capable of currents in excess of 250 kamp with a jitter time of less than 0.1 μsec while adding a switch-circuit inductance of about 0.035 μh to the total inductive load on the capacitor. (R.E.U.)

8630 DETERMINATION OF TRAJECTORIES IN A PLANE TRI-ELECTRODE LENS. E. S. Kochanov. Zh. Tekhn. Fiz., 33: 1301-10(Nov. 1963). (In Russian)

Analytical studies were made of pre-axis areas in a plane electrostatic lens. Optical properties of the lens were determined as functions of electrode intensities and geometric parameters. The results were utilized in electron-optical systems. (R.V.J.)

8631 INSTRUMENTATION AND DATA STORAGE IN KINETIC CLINICAL PROCEDURES. Alan L. Orvis (Mayo Clinic and Mayo Foundation, Rochester, Minn.). 30p. (CONF-355-1)

From Symposium in Medicine, Dynamic Clinical Studies with Radioisotopes, Oak Ridge, Tenn., Oct. 1963.

Developments in the fields of radiation detection, data storage, data presentation, and data analysis for clinical studies involving the use of radioisotopes are reviewed. (C.H.)

8632 ALTERNATIVE ION PUMP CONFIGURATIONS DERIVED FROM A MORE THOROUGH UNDERSTANDING OF THE PENNING DISCHARGE. W. Knauer and E. R. Stack (Hughes Research Labs., Malibu, Calif.). 13p. (CONF-209-17)

From American Vacuum Society Meeting, Boston, Oct. 1963.

An investigation of the Penning discharge has revealed that a specific motion pattern of the electrons is essential to its maintenance. The electrons must be able to move freely along the magnetic lines of force from cathode to cathode, and to carry out simultaneously an uninterrupted $E \times B$ drift in a direction normal to the magnetic field and parallel to the anode surface. It was observed that a similar motion pattern can exist in a wide choice of electrode geometries and that in each of them, a Penning-type discharge can be sustained. Several of the tested configurations hold promise for use in ion pumps. (auth)

8633 THE ION FOCUSING GAGE: A NEW HIGH VACUUM GAGE. H. H. Atkinson (Rutherford High Energy Lab., Chilton, Berks, Eng.). 9p. (CONF-209-15)

From American Vacuum Society Meeting, Boston, Oct. 1963.

In this gauge, comparable in size and simplicity to a Bayard-Alpert gauge, an electron beam (~100v) of high perveance is fired into a field-free drift space. Initially, the strong space-charge forces cause the beam to diverge radially. Positive ions formed by electron-gas collisions are trapped in the deep potential well of the beam and neutralize the space-charge so the beam gradually converges. The time rate of convergence, proportional to gas pressure, is easily measured without external amplification as a current increase (of several milli-amps) onto a target. The range is $<10^{-8}$ to 10^{-4} Torr and measurements are fast: e.g. 10^{-4} seconds at 10^{-6} Torr. (auth)

8634 RESPONSE OF MODIFIED REDHEAD MAGNETRON AND BAYARD-ALPERT VACUUM GAGES ABOARD EXPLORER XVII. G. P. Newton, D. T. Pelz, G. E. Miller, and R. Horowitz (Goddard Space Flight Center, Greenbelt, Md.). 22p. (CONF-209-14)

From American Vacuum Society Meeting, Boston, Oct. 1963.

Two Redhead and two Bayard-Alpert gauges were used to measure the density, pressure, and temperature of the upper atmosphere. Gauge pressures, from 10^{-6} to 10^{-10} torr, a function of satellite attitude, velocity, and atmospheric parameters, were measured over the altitude range from 260 to 900 kilometers. During the spin period of 0.67 second, the gauges recorded pressure changes as large as a factor of 30 (e.g., from 3×10^{-9} to 8×10^{-8} torr). Comparison of the independent gauge outputs yielded values in good agreement with kinetic theory predictions. (auth)

8635 SAMPLE COMPOSITION, BACKSCATTER COEFFICIENT AND TARGET CURRENT MEASUREMENT. Kurt F. J. Heinrich (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). 29p. (CONF-174-8)

From 12th Annual Conference Application of X-Ray Analysis, Denver, Aug. 1963.

Electron backscattering in electron impact on the target of an x-ray tube is discussed. The backscatter coefficient, which depends on the incident beam current and the backscatter current, is investigated. The backscatter coefficient is proposed as a means of determining the composition of complex targets. Proposed values of backscatter currents are given for most of the elements. (C.E.S.)

8636 METHOD FOR MEASURING LOW FLOW RATES. Charles Fremiot (to Commissariat a l'Energie Atomique). British Patent 940,474. Oct. 30, 1963. Priority date June 1, 1961, France.

A method for measuring low fluid-flow rates and a device for carrying out the method are patented. The method is particularly designed for measuring flow rates of a fluid feeding an ion source. A Hg mass is moved by the fluid, and the time elapsing between the passage of the free surface of the Hg between 2 separate levels is measured. The Hg is used as the core of a variable inductance coil in 2 oscillating circuits. One circuit resonates when the Hg is at a certain level, and the other circuit resonates when the Hg is at a different level. A timing system is started and stopped by the resonance of the circuits, so the time required for the Hg to go from one level to the other is measured. (M.P.G.)

8637 IMPROVEMENTS IN OR RELATING TO ELECTRICAL CONDUCTORS. Stanley Charles Frederick Wills, Donald Montague Bale, and Philip John Grantham (to Strachan and Henshaw Ltd.). British Patent 946,599. Jan. 15, 1964. Filed Sept. 11, 1961.

A composite insulated flexible electric conductor was developed. It consists of at least one flexible core conductor member, a plurality of insulators loosely positioned in spaced relation on the flexible core, a plurality of metallic spacing members of less diameter than the insulators secured on the core at intervals in spaced relation leaving the insulators limited freedom of movement along the core between the spacing members, and a flexible metallic sheath in which the insulators are slidable. The spacing of the insulators is such that the assembly can be flexed to a predetermined minimum radius without the spacing members coming in contact with the flexible metallic sheath. (M.C.G.)

8638 HIGH VACUUM MASS ANALYSER APPARATUS. Arthur B. Francis, Alfred E. Barrington, and John C. Helmer (to Varian Associates). U. S. Patent 3,117,224. Jan. 7, 1964. Filed July 31, 1961.

Apparatus for high-vacuum mass analysis utilizing a mono-voltaic positive ion source is described. The ion gun, focusing lens, magnetic deflector, and electrostatic deflector are arranged to produce an improved high-vacuum leak detector. The pole pieces are arranged in the gas discharge device so as to provide an improved high-vacuum ion source. The electrodes of the gas-discharge ion gun may be supplied with variable voltages to produce a flexible positive ion source. (M.C.G.)

8639 ACCELERATOR TYPE NEUTRON SOURCE WITH SHUTTER MOUNTED BETWEEN THE DRIFT TUBE AND THE FOCUSING MEANS. Herbert P. Yule (to California Research Corp.). U. S. Patent 3,117,230. Jan. 7, 1964. Filed Aug. 5, 1959.

A neutron source was designed for the generation of neutrons by the deuterium–tritium process in accurately timed pulses to permit detection of inelastically scattered gamma rays and thermal-capture gamma rays from various nuclei in an earth formation without simultaneous generation of large numbers of low-energy neutrons by the deuterium–deuterium process. Means are provided for mechanically interrupting a beam of charged particles as they traverse an elongated accelerator tube from an ion source immediately ahead of the target. The shutter has pie-shaped openings and the shutter is rotated into and out of the path of the beam. The shutter is made of aluminum and the beam-contacting surface is coated with a material having a relatively high Z and a low surface-adsorption coefficient for particles accelerated in the beam. (M.C.G.)

Radiation Detection

Refer also to abstracts 8104, 8548, 8599, 8869, and 8918.

8640 (BNL-7616) CHARACTERISTICS OF A DIGITIZED DISCHARGE HODOSCOPE. J. Fischer, G. B. Collins, and W. A. Higinbotham (Brookhaven National Lab., Upton, N. Y.). [Nov. 22, 1963]. Contract [AT(30-2)-Gen-16]. 16p. (CONF-369-2)

From International Symposium on Nuclear Electronics, Paris, Nov. 1963.

Digitized discharge planes were studied to determine their utility in high energy hodoscope experiments. One plane consists of a 6 × 6 in. frame covered on one side with a conducting sheet and on the other with 64 parallel wires. The thin enclosed volume is filled with a neon-helium-alcohol mixture. Each wire passes through a ferrite memory core to ground. The conducting sheet is pulsed to a high voltage, in the manner of spark chambers, after passage of an ionizing particle. Three such planes were tested in a high energy proton beam. An efficiency of 99% was achieved with an average of 1.5 to 2 wires involved per discharge. The spatial resolution was 0.5 mm. Data are presented on efficiency, number of wires per discharge, dead time, and temporal and spatial resolution. (auth)

8641 (HW-76279) FIXED-TIME ESTIMATION OF COUNTING RATES WITH BACKGROUND CORRECTIONS. W. L. Nicholson (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 1963. Contract AT(45-1)-1350. 209p.

Statistical rules to be used in estimating and interpreting the net sample counting rate in the presence of appreciable background are developed. The importance of good background estimation is considered. (D.C.W.)

8642 (HW-SA-3225) APPLICATION OF MULTIDIMENSIONAL GAMMA-RAY SPECTROMETRY. R. W. Perkins (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 8, 1963. Contract AT(45-1)-1350. 18p. (CONF-313-5)

From 2nd National Meeting of the Society for Applied Spectroscopy, San Diego, Calif., Oct. 1963.

A gamma spectrometry system (described) consisting of two anticoincidence NaI(Tl) detectors and a 4096-channel pulse analyzer was used to measure the gamma spectrum of Hanford reactor effluent water. Many minor radionuclides that could not be measured directly or precisely from the normal spectrum were readily measured from the multidimensional spectrum. Much of the natural radioactivity of soils is also easily measured with this system. Greater sensitivity in radionuclide mixture measurements was also attained. (D.C.W.)

8643 (IS-575) NEW DESIGN OF A COMPLETELY AUTOMATED HIGH PRECISION CURVED-CRYSTAL SPECTROMETER. Hans Toffer and Eastman Hatch (Ames Lab., Ames, Iowa). Nov. 1962. Contract W-7405-eng-82. 52p.

The need for precision gamma-ray energy determinations and the justification for developing curved-crystal gamma-ray spectrometers is discussed. A short history of the development of these spectrometers is given followed by a listing of existing instruments with their appropriate characteristics and capabilities. The proposal for an automated curved-crystal spectrometer is given in detail. Special emphasis is placed on the application of the Razdow Laboratory Midarm (Micro Dynamical Angle and Rate Monitor) System and the on-line IBM 1710 Control and IBM 1620 Data Processing System. An extensive bibliography and a listing of single crystal producers, precision angle measuring devices, and positioning tables are presented. (auth)

8644 (JAERI-1052) EFFECTIVE CADMIUM CUTOFF ENERGY FOR CYLINDRICAL DETECTORS WITH CYLINDRICAL FILTERS. Renzo Takeda and Kazuhiko Inoue (Japan Atomic Energy Research Inst., Tokyo). Sept. 1963. 11p. (In Japanese)

The effective cutoff energies for cylindrical detectors with cylindrical filters in an isotropic neutron flux were studied. The neutron spectra used in the calculation of the effective cutoff energy were those for infinite, homogeneous media using the free gas model of the deuteron and carbon. The effective cutoff energy for a cylindrical detector with a cylindrical filter in the isotropic neutron flux has a value between those for a slab filter in the isotropic neutron flux and the beam neutron flux. The change of the position of the detector considerably influences the value of the effective cutoff energy. The self-shielding effect in micro BF_3 proportional counters and U^{235} fission counters can be neglected. (auth)

8645 (NIRL/R/50) A GEOMETRY PROGRAM FOR HEAVY LIQUID BUBBLE CHAMBERS. J. Sparrow (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Chilton, Berks, England). Aug. 1963. 17p.

The modifications and additions made to the geometrical reconstruction program used at the Rutherford High Energy Laboratory to make it suitable for dealing with tracks in heavy liquid bubble chambers are described. (auth)

8646 (NYO-2740-1(p.54-74)) RADIATION PROTECTION. (Columbia Univ., New York. Radiological Research Lab.).

The V chamber consists of two ionization chambers that are identical except that one chamber has tissue equivalent walls and gas and the other chamber has teflon walls, a tissue equivalent collecting electrode, and CO_2 gas. Results are reported from dose equivalent measurements in mixed neutron and γ radiation fields using the V chamber. (C.H.)

8647 (NYO-2740-1(p.75-90)) OTHER PHYSICS. (Columbia Univ., New York. Radiological Research Lab.).

Design features are described for a very thin window x ray tube capable of handling large anode currents below 5 kv. A schematic cross section of the tube is included. Applications in radiobiological studies are discussed briefly. An experimental quartz-insulated ionization chamber was designed and constructed to eliminate all rubber and plastic from the gas volume. The disintegration rate of Y^{90} in solution was determined by the use of a thin window G-M counter and a calibrated solution of Sr^{90} and Y^{90}. The procedure is described. (C.H.)

8648 (RISÖ-67) MEASUREMENT OF γ-FLUX IN A THERMAL COLUMN WITH AN OXALIC-ACID DOSIMETER. J. Fenger (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Sept. 1963.

Oxalic-acid dosimeters consisting of 600 μl 0.05 M oxalic-acid solutions in light and heavy water (D_2O) in evacuated quartz ampoules were calibrated in a Co^{60} irradiation facility. The G-value for decomposition of oxalic acid in heavy water was found to be about 10% lower than the G-value in light water. This observed isotope effect has the opposite sign of the one usually found in irradiated aqueous solutions. It is tentatively ascribed to an increased cage effect in D_2O. The G-value in light water was found to be 4.6 or about 6% lower than the value of 4.9 reported by Draganic. The dosimeters were used to measure the γ dose rate in four positions in the thermal column of the Danish reactor DR 2. The light-water dosimeters indicated an ~10% higher dose rate than the heavy-water dosimeters. It is shown that this difference can be explained as increased radiolysis due to γ quanta from neutron capture in the hydrogen nuclei of the light water. (auth)

8649 (TID-19940(p.77-118)) EXPERIMENTAL INSTRUMENTATION. (Minnesota. Univ., Minneapolis. Linear Accelerator Lab.).

The properties of the 60° sector beam analyzing magnet and the 180° spectrometer were investigated, and elastic spectra for 10-Mev protons scattered on Au were obtained with solid state detectors to study the resolution as well as the spectral shapes. Also a 32-solid state detector array for the magnetic spectrometer was designed, and use of a Hall probe to measure and control the spectrometer field was investigated. Other developments included a one-dimensional multiwire spark chamber, an ion source beam monitor, an alpha particle scanner, and assorted circuitry. (D.C.W.)

8650 (AEC-tr-6049(p.100-34)) DETERMINATION OF THE ACTIVITY OF INDIVIDUAL ISOTOPES. (Translation)

Methods are discussed for the measurement of the activity of individual radioisotopes. Topics discussed in detail include methods of measuring the absolute β-activity of samples, the design and operation of 4π counters, methods for counting β-γ coincidences, and methods of measuring α activity. The design characteristics of radiation detection instruments most commonly used in these measurements are discussed. (C.H.)

8651 4-π PROPORTIONAL COUNTERS FOR THE CALIBRATION OF ABSOLUTE ACTIVITIES. P. Lerch, J. J. Gosterly, and R. Lemp (Hôpital Cantonal Universitaire, Lausanne, Switzerland). Chimia (Aarau), 17: 378-81(Dec. 1963). (In French)

A routine method is proposed for the measurement of pure β emitters by 4-π proportional counting. The conditions were determined for rapid absolute measurements, with an error less than 5%, provided self absorption is negligible, and β energy is greater than 0.1 Mev. (auth)

8652 A "LARGE CRYSTAL" SCINTILLATION SCANNER. T. D. Cradduck, S. O. Fedoruk, and J. A. MacKay (Saskatoon Cancer Clinic, Saskatchewan, Can.). J. Nucl. Med., 5: 27-39(Jan. 1964).

A description is given of a radio-isotope scanner which employs a 5.25 diameter × 4 in. deep NaI crystal as the primary detector in conjunction with various types of collimators. The scan is displayed on the face of a cathode ray oscilloscope and recorded on a Polaroid transparency. A magnetic tape recording is made to ensure that no scan information is inadvertently lost, but is stored for later reference. The transparency of the scan may be displayed at life size with varying levels of intensity on a television screen, so that minor variations of count rate may be emphasized to enhance areas of low uptake. (auth)

8653 METHOD FOR DIMINISHING THE DOSE SENSITIVITY ENERGY DEPENDENCE IN GAMMA DOSE RATE MEASURING BY MEANS OF RELEASE COUNTERS. L. Schwaar and G. Entress (VEB Vakutronik, Dresden). Kernenergie, 6: 617-21(Nov. 1963). (In German)

A method is described, which is advantageous for decreasing the energy dependence of release counters for dose rate measurements. For this purpose an absorber can be used, which is erected, for instance, rotationally symmetric to the counter axis and possesses variable thickness along the counter axis. A method for calculations for such an absorber is given and the efficiency of the method was demonstrated on a practical example. (tr-auth)

8654 MEASUREMENT OF LIQUID SCINTILLATION COUNTING EFFICIENCIES. Horace E. Dobbs (United Kingdom Atomic Energy Research Establishment, Wantage, Berks, Eng.). Nature, 200: 1283-4(Dec. 28, 1963).

A method is described for determining the efficiency of phosphor solutions. The method has the advantage of the internal standard method, but eliminates the two disadvantages of the method in that the sample is in its original form after the measurement, and the personal error is eliminated as the amount of activity added for each determination does not vary. A glass rod carrying a fused coating of a suitable long-lived isotope is inserted into the liquid scintillator, and the resulting rise in counting rate is used to measure the counting efficiency of the solution. The method has the advantage that results can easily be cross-checked by recounting the solution after the introduction of another efficiency stick containing more, or less, activity. (P.C.H.)

8655 A LARGE SPARK CHAMBER FOR POLARIZATION MEASUREMENTS. P. Autones, P. Bareyre, J. M. Gaillard, G. Robert, and R. Seige (CEN. Saclay, France). Nucl. Instr. Methods, 24: 418-24(Nov. 1963).

A 60 × 80 × 60 cm^3 spark chamber with thin foils and graphite plates is described. Design considerations and details of the different parts of the apparatus are presented. Special emphasis is put on chamber optics and performances. (auth)

8656 ABSOLUTE CALIBRATION OF A WILSON TYPE "QUANTAMETER." R. Gomez (California Inst. of Tech., Pasadena), J. Pine, and A. Silverman. Nucl. Instr. Methods, 24: 429-34(Nov. 1963).

The calibration is done by comparing the Quantameter to a Faraday cup. The calibrations were done with electrons of 866, 525, and 315 Mev, and also using bremsstrahlung produced by 866-Mev electrons striking a thin radiator. The measured calibration constant was found to be independent of energy within the accuracy of the experiment and

the mean value for all the measurements was $U_q = (4.62 \pm 0.07) \times 10^{18}$ Mev/coulomb. The calculated value is 4.79×10^{19} Mev/coulomb with an estimated accuracy of three percent. The major uncertainty in the calculated result is the value of the energy loss per ion pair. (auth)

8657 A METHOD FOR EFFICIENCY DETERMINATION IN AREA SCANNING. Y. K. Lim (Univ. of Singapore, China). Nucl. Instr. Methods, 24: 435-40(Nov. 1963).

A double-scan method proposed previously for determining the efficiency in area-scanning for events in nuclear emulsions was extended to include the case where the events consist of a number of groups among which the scanning efficiencies differ considerably. The new method involves three separate scannings of the same test area. The applicability of the method to the various situations likely to be encountered in an actual scanning is demonstrated using simplified hypothetical examples. (auth)

8658 COMBINATION OF A SCINTILLATOR AND A SEMICONDUCTOR PHOTODIODE FOR NUCLEAR PARTICLE DETECTION. N. G. Blamires (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nucl. Instr. Methods, 24: 441-4(Nov. 1963). (AERE-M-1185)

Surface barrier junction-diodes with high photosensitivities in the 4,000 Å region were made by using very thin evaporated gold contacts (≈20 $\mu g/cm^2$). These photodiodes were used in conjunction with scintillators as nuclear particle detectors. Properties of the devices when used with various scintillators to detect α particles and protons are presented. Under favorable conditions of geometry, the nuclear particle energy required to produce one carrier pair is 70 ev, indicating a very high conversion efficiency between photons produced in the crystal and electrons produced in the photodiode. This is to be compared with a value of 500 ev for a scintillator/S11 photo-cathode combination. The overall energy resolution is still rather less than can be achieved with a good photomultiplier, for energies up to 50 Mev, because of the much greater electrical noise associated with the photodiode. (auth)

8659 A GAMMA-RAY DETECTOR FOR NEUTRON CAPTURE CROSS-SECTION MEASUREMENTS. M. C. Moxon and E. R. Rae (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nucl. Instr. Methods, 24: 445-55(Nov. 1963).

A scintillation gamma-ray detector is described whose efficiency for detecting neutron capture events depends only on the total gamma-ray energy released. The detector is cheap and fast; it has a low background and a low sensitivity to neutrons in the energy range studied (up to ~100 kev). A description is given of the use of the detector with an electron linac neutron time-of-flight system, and results are presented of capture cross section measurements on rhodium, silver, indium, tantalum, and gold, over the energy range 100 ev to 50 kev. (auth)

8660 A NULL METHOD FOR CALIBRATING FARADAY CUPS. J. F. Hague, R. E. Jennings, and R. E. Rand (Univ. of London). Nucl. Instr. Methods, 24: 456-60(Nov. 1963).

The efficiency of a Faraday cup for 29-Mev electrons was measured to within 0.2% by a null method using a toroidal coil transformer. Similar accuracy can readily be obtained with all beams having pulse currents ≥50 μamp. The method enables integrated beam currents to be determined absolutely without using a total-absorption cup. (auth)

8661 A SYSTEM FOR STUDYING ACCELERATOR-PRODUCED SHORT-LIVED ALPHA EMITTERS. R. D. MacFarlane and R. D. Griffioen (Univ. of California, Berkeley). Nucl. Instr. Methods, 24: 461-4(Nov. 1963). (UCRL-10952)

A target assembly and detection system is described that has applications for studying accelerator-produced short-lived alpha activities with good efficiency and excellent alpha particle resolution. The system is simple and fast and allows for the continuous recording of alpha particle spectra at the same time the activity is produced. (auth)

8662 LOW-LEVEL BETA ACTIVITY MEASUREMENT OF SOLID SAMPLES USING PLASTIC SCINTILLATOR ANTICOINCIDENCE. U. C. Mishra and R. Kerala Varma (Atomic Energy Establishment, Trombay, India). Nucl. Instr. Methods, 24: 473-6(Nov. 1963).

An instrument consisting of a G-M counter shielded by a plastic-scintillator-cone and 15 cm of lead was designed giving a background of 12 counts per hour. The sample spread in an area of nearly 3 square centimeters can be counted in a nearly 2π geometry, with an overall counting efficiency of about 15 percent for potassium-40 betas. Thus, thin solid samples of activity less than 10^{-13} curies per square centimeter can be measured in 4 hours sample counting time with about ±20% accuracy. The factor limiting the background is probably only the internal contamination of the counting system. A further reduction in background can be attained by using special low-level G-M counters. The instrument is ideally suited for pure beta emitters like strontium-90 for which it was primarily developed, but it can also be used for beta-gamma emitters as described. The limitations in this case are discussed and preliminary results with different beta-gamma emitters are given. (auth)

8663 ANALYSIS OF CHANCE COINCIDENCES IN FAST-SLOW COINCIDENCE SYSTEMS. E. B. Shera, K. J. Casper, and B. L. Robinson (Western Reserve Univ., Cleveland). Nucl. Instr. Methods, 24: 482-92(Nov. 1963).

A complete treatment is given of the various processes that contribute to the chance coincidence rate in a two-fold fast-slow coincidence system and a similar analysis for the three-fold system is carried to second order. The effects of circuit and detector deadtimes are included and methods are suggested for the elimination of all chance-coincidence contributions that do not result exclusively from the finite resolving time of the fast coincidence circuit. (auth)

8664 A NEW METHOD FOR DETERMINING THE POSITION OF A SPARK IN A SPARK CHAMBER BY MEASUREMENT OF CURRENTS. G. Charpak, J. Favier, and L. Massonnet (CERN, Geneva). Nucl. Instr. Methods, 24: 501-2(Nov. 1963).

A method is proposed for nonphotographic positioning of sparks. In the chamber, the charge from a condenser discharges to ground through the conductive channel produced by the spark. The grounded plate is connected to ground at two opposite points and the current is thus divided between the two different channels, according to their relative impedance, which is a function of spark position. (R.E.U.)

8665 RADIOLUMINESCENCE OF ACTIVATED LITHIUM IODIDE SINGLE CRYSTALS. G. A. Mikhal'chenko and I. K. Karpov. Opt. Spectry. (USSR) (English Transl.), 15: 264-5(Oct. 1963).

Single crystals of europium-, tin-, thallium-, indium-, gallium-, copper-, silver-, and gold-activated lithium iodide were synthesized. Optical luminescence spectra and energy yields were determined for all these crystal phosphors upon

excitation with β particles from Sr^{90}. Scintillation pulse heights and energy discrimination were measured for slow neutrons. (auth)

8666 FLUOROGLASS DOSIMETER AND ITS STANDARDIZATION. Kakuji Yamamoto (Tokyo Metropolitan Isotope Center). Oyo Butsuri, 32: 421-9(June 1963). (In Japanese)

The properties of a fluoroglass dosimeter and its standardization are described. The improved fluoroglass composed of mainly $LiPO_3$ and $Al(PO_3)_3$ contains 8% $AgPO_3$ and 3% B_2O_3. After this glass is exposed to radiation, fluorescence of 640 mμ is generated. The response of the fluoroglass dosimeter is in a linear relation to the accumulated dose, and is independent of the dose rate in the range 0.1 mr/min–100 r/min. The response rapidly increases with decreasing radiation energy through a maximum, but, when a filter is used in order to avoid this undesirable energy dependency, the change of response scarcely occurs. When its shape is made to be cubic, the change of response due to the difference of radiation direction can be ignored. In the ordinary temperature range, temperature has no effect, and it is favorable to measure the fluorescence after 3 hours with due consideration for build-up effect. To standardize the dosimeter for γ and x rays of 100 kev–3 Mev, the composition of glass, the size, the performance and reference glass are discussed. The Japanese Industrial Standard plan is also described. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8667 A STUDY OF A NEW METHOD FOR MEASUREMENT OF PARTICLE TRAJECTORIES AND IONIZATION LOSS, BASED ON ELECTROSTATIC INFORMATION STORAGE AND ELECTRON BEAM INFORMATION READ OUT. Kjell Budal. Proc. Phys. Seminar Trondheim, No. 9, 1-65 (1963).

The potentialities of a track measuring device based in principle on the ionization detector are discussed. The operation is based on collection of the ionization charge from an event, with or without prior internal amplification, on the insulating chamber wall. The particle track information is thus stored as a charge configuration. The charge pattern is then neutralized and at the same time measured by an electron beam, scanning the surface at high frequency. The particle track may then be viewed on a television monitor or the information may be stored on magnetic tape or digitized for computer handling. The characteristics of detectability of particle track, ionization loss measurements, space resolution, time resolution, dead time, applicability of triggering, speed of readout, size, simplicity, and costs are investigated. The properties of various chambers and track measuring devices are summarized. 46 references. (R.E.U.)

8668 OBSERVATION OF THE TRACKS OF FAST PARTICLES IN A TWO-ELECTRODE SPARK CHAMBER LOCATED IN A MAGNETIC FIELD. A. I. Alikhanian, T. L. Asatiani, E. M. Matevosian, A. A. Nazaryan, and R. O. Sharkhatunian (Inst. for Theoretical and Experimental Physics, USSR). Phys. Letters, 7: 272-4(Dec. 1, 1963).

Investigations were made on particles moving parallel to the spark chamber electrodes separated by 15 to 20 cm. Some applications of the chamber are discussed. (R.E.U.)

8669 RADIOMETRIC TECHNIQUES AND INSTRUMENTATION FOR IN-LINE PROCESS MONITORING. H. Bisby (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 251-81(1963).

The principles that govern the application of radiometric techniques to process monitoring are stated, and the main basic design features, which generally apply, are illustrated by examples from recently developed instrumentation. (auth)

8670 D. C. MEASUREMENTS IN THE CURRENT IONIZATION CHAMBER. Jadwiga Jablonska and Konrad Jablonski. Przeglad Elektron., 4: 356-71(July 1963). (In Polish)

A number of basic methods of accurate d-c ionization chamber measurements are discussed. These include measurements in which a standard condenser is charged, measurements in which the voltage drop is measured across a resistor of high resistance value, measurements in which a compensated ionization chamber is used, and measurements with continuous compensation utilizing negative feedback circuitry. Sources of systematic error are discussed for each method of measurement, and means are presented for eliminating some of the sources of systematic error. (TTT)

8671 TECHNOLOGICAL PROBLEMS OF THE NUCLEAR RADIATION DETECTORS USED IN THE REACTOR TECHNIQUE. Zygmunt Bieguszewski, Wacław Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 372-83(July 1963). (In Polish)

The radiation detector technology described represents the background and experience developed in the course of seven years of constructing, testing, and using detectors, mostly with the reactor EVA, for the purpose of reactor control and safety. Several scores of detectors of the types described were used, and the majority of these were successfully used for periods of many months. After long exposures, the detectors were in each case disassembled and studied for cleanliness of the gas, the condition of the coating, the degree of corrosion, and the quality of the insulation. From these tests, the resulting technology led to the construction of successful detectors for a reactor operating at temperatures up to 50°C. Work was begun on the design of detectors to operate in the 200 to 300°C region for safety and control of the Polish reactor II. (TTT)

8672 TESTING METHODS OF THE NUCLEAR RADIATION DETECTORS USED IN THE REACTOR TECHNIQUE. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 384-7(July 1963). (In Polish)

After initial electrical tests such as resistive and capacitative measurements, neutron and gamma detectors are subjected to a battery of performance tests before being accepted for actual use in reactor control and safety. These tests consist of determination of neutron and gamma sensitivity over long periods of time and over a range of operating conditions. The detectors are exposed to known radiation fields for stability tests, to intense gamma fields for radiation-damage sensitivity, to both neutron and gamma fields for the testing of compensated detectors (as a function of applied voltage to determine the voltage for optimum compensation), and to a range of known radiation for linearity checks. The detectors are checked periodically. For these tests, three radiation sources are used: ports in the reactor EVA, the thermal column of the EVA reactor, and a region in the thermal column where spent fuel elements may be placed; a neutron source with associated graphite moderator and channels for detectors and spent fuel elements (up to $5 \times 10^3 n/cm^2 sec$); and a matrix of spent fuel elements with a central testing port (1 r/hr to 2.5×10^5 r/hr). (TTT)

8673 NEUTRON SENSITIVE IONIZATION CHAMBER AKJ-150/0.8 TYPE. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 388-9(July 1963).

The detector described is sensitive to neutrons by virtue of a large electrode that is coated with a 0.8 gm/cm^2 layer of boron, which is sprayed on the electrode in the form of a liquid suspension of fine boron powder. This suspension is dried and fired onto the electrode. The detector has an outside diameter of 52 mm and an overall length of 280 mm. Its sensitivity is 8×10^{-15} amp/neutron-cm^2-sec to thermal neutrons with a coating of natural boron. No gamma compensation was employed, but the gamma sensitivity was made small compared to neutron sensitivity by optimal electrode design. The counter was designed for use in regions of high thermal neutron flux (greater than 10^9 n/cm^2-sec). (TTT)

8674 γ-COMPENSATED NEUTRON SENSITIVE IONIZATION CHAMBER RAKJ-5-TYPE. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 390-4(July 1963). (In Polish)

The detector described consists of a coaxial cylindrical region that is neutron sensitive and within that a gamma-compensation region. Both surfaces of the outer two cylindrical electrodes are coated with 0.8 mg/cm^2 of fired natural boron. The gamma-compensation region consists of a smooth outer cylindrical electrode and a grooved inner cylindrical electrode. The grooved electrode gives rise to a gamma sensitivity that is non-saturating in that the collection current is a function of interelectrode voltage. The operating voltage is chosen to give optimum gamma compensation over a wide range of gamma dosage, and current-versus-voltage curves are given for gamma fluxes up to 2.7×10^5 r/hr. The chamber has a sensitivity of 2×10^{-14} amp/neutron/cm^2-sec for thermal neutrons and 10^{-11} amperes/r/hr gamma sensitivity (uncompensated). The chamber is linear to neutron-currents of nearly 300 microamperes. (TTT)

8675 REACTOR START-UP FISSION CHAMBERS. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 394-7(July 1963). (In Polish)

Two fission chambers, RAM-501 and RAMW-501, were designed, tested, and put to use in the reactor EVA and in the critical assemblies ANNA and MARYLA. The two types of chambers are identical except that RAM-501 has an electrode coated with natural uranium and RAMW-501 with 10% U^{235}. The sensitive volume of the counter is defined by several concentric cylinders of which three cylindrical surfaces are coated with uranium to a thickness of about 1 mg/cm^2. With an active area of about 500 cm^2, the counting rate at the plateau is about 3×10^{-3} neutron/cm^2-sec with natural uranium and about 4×10^{-2} neutron/cm^2-sec with uranium enriched 10% in U^{235}. The rise time of the pulses is about 0.08 μsec, allowing for counting rates of up to 10^6/sec before significant count-loss occurs due to chance coincidences. The filling-gas is a 2.5 atmosphere charge of 99.99% pure argon with 2% nitrogen added. (TTT)

8676 NUCLEAR RADIATION DETECTORS USED IN REACTOR PHYSICS EXPERIMENTS. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 397-402(July 1963). (In Polish)

Three types of radiation detectors that were successfully used in reactor physics experiments are described in terms of design and performance characteristics. The first is a neutron-sensitive ionization chamber used for pile oscillator measurements with the critical assembly ANNA. It is a gamma-compensated chamber. Boron is fused to the aluminum electrode. The second type of detector is a fission counter lined with natural uranium, and its counterpart, lined with uranium enriched in U^{235}. The construction of this counter with its low sensitivity and small diameter makes it uniquely suitable for flux-mapping along the length of a reactor's access port. The third detector is a miniature ionization chamber for gammas. It is an air-filled ionization chamber with active volume of 14 cm^3, a sensitivity of 10^{-12} amp/r/hr and a linearity up to 3×10^{-7} amp with the collector voltage at 600 volts. (TTT)

8677 IONIZATION CHAMBERS FOR ACTIVATION METHOD NEUTRON FLUX DISTRIBUTION MEASUREMENTS. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, and Jerzy Topa. Przeglad Elektron., 4: 403-8 (July 1963). (In Polish)

Two ionization chambers are described; a 4-π gamma chamber and a 4-π beta detector. The gamma chamber is 143 mm in diameter and has a reentrant sample-port that allows the sample to be located in a region almost completely (4-π) surrounded by the sensitive volume of the ionization chamber (20 atm argon gas). The chamber has a sensitivity of 2.7×10^{-12} amp/μC for Co^{60} gammas, and 5.2×10^{-13} amp/μC for gold gammas. The chamber was designed with the range 3×10^{-15} to 10^{-6} amp in mind but insulation leakage limited the lowest current readings to about 10^{-13} amperes. The beta chamber is a pancake-shaped ionization chamber with a thin-walled sample port passing clear through the axis of the pancake. This design makes the chamber especially suited for flux mapping by activating wire samples of gold, indium, etc. (TTT)

8678 INSTALLED γ-RADIATION MONITOR WITH D. C. PRESSURE IONIZATION CHAMBER KPDG-1/10 TYPE. Waclaw Dabek, Jadwiga Jablonska, Andrzej Janikowski, Bronislaw Szczechla, and Jerzy Topa. Przeglad Elektron., 4: 409-13(July 1963). (In Polish)

The radiation monitor was designed as a personnel monitor and safety monitor for the critical assembly ANNA. The monitor circuit has a logarithmic response that is accurately logarithmic in the range 10^{-13} to 10^{-6} amp. The sensitivity of the associated chamber is 10^{-12} amp/mr/hour for Co^{60} gammas. The monitor can be preset to sound an alarm or shut down the critical assembly at any predetermined level in its operating range. The associated electronic preamplifier and input resistors are kept hermetically sealed to maintain greater stability. (TTT)

8679 MODIFICATION OF THE ROSENBLUM SPARK COUNTER. Myron Jeffries (Univ. of Cincinnati). Rev. Sci. Instr., 35: 22-4(Jan. 1964).

A modification of the Rosenblum spark counter was made by cutting a slit in the plate and allowing a beam of alpha particles to pass through it. The sensitive volume is thus made more accessible and there is a considerable increase in count rate. The characteristics of the counter operated in this manner were examined for varying thicknesses of wire. An explanation of some of the results is attempted by an analysis of the field around the wire. (auth)

8680 POWER CALORIMETRY OF FAST-PARTICLE BEAMS. E. S. Chambers (Univ. of California, Livermore). Rev. Sci. Instr., 35: 95-7(Jan. 1964). (UCRL-7459)

Equations are developed for the temperature behavior of a target struck by a particle beam. The temperature change is obtained as a function of time for given beam power, heat capacity, and conductivity. Using thermistors to measure temperature difference, a calorimetric target

was developed with a sensitivity of about 5 μw. Such a detector is capable of comparing ion and neutral beams. (auth)

8681 SYSTEM FOR CONTINUOUS GENERATION AND FAST TRANSFER OF RADIOACTIVE GASES. Frances Pleasonton and C. H. Johnson (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr., 35: 97-102(Jan. 1964).

A system was developed to provide a stable and strong source of He^6 for the Oak Ridge National Laboratory recoil spectrometer. A continuous flow of water-vapor swept the He^6 through about 80 ft of piping from the generator to the laboratory in 3 to 4 sec; the gas was then purified and delivered to the spectrometer in an additional 1 to 1.5 sec. Modifications in design for other experiments and for use in leak detecting are discussed. (auth)

8682 HIGH VOLTAGE PULSE PROBE OF FAST RISE TIME FOR SPARK CHAMBERS. J. Fischer (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr., 35: 125-6(Jan. 1964).

A probe is described that allows oscilloscope display of the shapes of individual high-voltage pulses with amplitudes from about 100 v to 25 kv, pulse widths of 5 nsec to several μsec, and pulse rise times as short as 2 nsec. The input stage is described. (R.E.U.)

8683 ON THE FILM DOSIMETRY OF FAST ELECTRONS. Gerhard Breitling and Wolfgang Seeger (Universität, Tubingen, Ger.). Strahlentherapie, 122: 483-92 (Dec. 1963). (In German)

The dependence on energy and direction of the sensitivity of photographic emulsions to fast electrons was investigated. The sensitivity for ultrahard x rays was compared with that for fast electrons. Results show that in a linear area the density is proportional to the energy released to water. Therefore, photographic emulsions are suitable for dosimetry of fast electrons. (auth)

8684 SPARK CHAMBER RECORDING EFFICIENCY FOR CHARGED PARTICLE SHOWERS. V. A. Bolotov and M. I. Devishev (Lebedev Inst. of Physics, Moscow). Zh. Eksperim. i Teor. Fiz., 45: 1680-2(Oct. 1963). (In Russian)

Two neon-filled 600 × 600 mm spark chambers with 70- and 90-mm distances between electrodes and a two-millimeter duraluminum electrode between them were used for determining the efficiency of a two-electrode spark detector. A 2-cm layer of lead over the chambers generated cosmic electron showers. A plastic scintillator with a FEU-33 photomultiplier was placed under the chambers. Chamber recording efficiencies for showers (q) and for separate particles in a shower (Q) were recorded. The magnitude q was recorded as the ratio of the number of showers recorded simultaneously in both chambers to the total number of showers recorded in one chamber. The shower recording efficiencies were: $q_1 = 0.95 \pm 0.05$ and $q_2 = 0.94 \pm 0.05$ (for electrode distances of 90 and 70 mm, respectively). The magnitude of Q was evaluated as the ratio of recorded particles to the total number of particle passing through an effective area at <40° angle. The values were $Q_1 = 0.78 \pm 0.06$ and $Q_2 = 0.73 \pm 0.17$ at mean particle numbers $N_1 = 18.6 \pm 2.1$ and $N_2 = 20.0 \pm 5.7$. The shower efficiency plotted as a function of the number of passing particles showed that within statistical error the magnitude does not fluctuate. Data processed without sparks found away from the shower axis showed $Q_1 = 0.92 \pm 0.07$, which did not vary for a month. (R.V.J.)

8685 ANALYSIS OF FAST PARTICLE TRAJECTORIES IN A DIELECTRODE SPARK CHAMBER IN A MAGNETIC FIELD. A. I. Alikhanyan, T. L. Asatiani, E. M. Matevosyan, A. A. Nazaryan, and P. O. Sharkhatunyan (Inst. of Physics, Erivan). Zh. Eksperim. i Teor. Fiz., 45: 1684-7(Oct. 1963). (In Russian)

A spark chamber arrangement is suggested that has several advantages over those previously described. At comparably small high voltages of ~60 to 70 kv with discharge intervals of 20 to 25 cm and ~1.2 atm of neon pressure, the length of the chamber can be a meter or more. The chamber is capable of recording particle tracks between electrodes, the decay products of neutral particles, or particles produced in the chamber gas. A picture is shown of the circular trajectory of an ~34-Mev electron produced in the gas by a γ quantum. (R.V.J.)

8686 DESIGN, CONSTRUCTION AND TESTING OF NEUTRON DIFFRACTION EQUIPMENT FOR A WWR TYPE REACTOR. K. Kleinmueller. Thesis, Dresden, Technische Hochschule, 1961. 143p. $2.00 (Gmelin, AED-DISS. 61-350)

The design and construction of two neutron spectrometers are described. The first is a one-circle apparatus with discontinuous angle advance. The angle accuracy is 0.2 min. The second spectrometer uses a fixed monochromator and a discontinuous nonequidistant angle advance. The properties of BF_3 counters are discussed. An arrangement for the calibration of the spectrometer with a Po–Be source is described. Rules for optimal beam collimation are given. The absorptivity of Bi filters is studied. (Gmelin Inst.)

8687 NATURAL RADIOCARBON MEASUREMENTS BY LIQUID SCINTILLATION COUNTING. John Edward Noakes. Thesis, College Station, Tex., Agricultural and Mechanical Coll., 1963. 144p.

A synthesis of high purity benzene in 50 to 60% yields that is suitable for low level liquid scintillation counting is described. The method involves a low temperature catalytic conversion of acetylene to benzene which was first reported by I. Shapiro and H. G. Weiss in 1957. Application of this method to C dating essentially eliminates previous problems encountered in the use of liquid scintillation counting for this purpose. The method extends the sensitivity of the C dating method and yet requires only standard commercially available counting systems. Interlaboratory check samples obtained from the U.S.G.S. C^{14}-dating laboratory were dated with good agreement. Application of this method has been made in determining the natural radiocarbon content of 14 archeological samples, 15 geological samples, and 2 marine water samples. (Dissertation Abstr.)

8688 NEUTRON MEASUREMENTS FOR CORROSION STUDIES IN LARGE REACTORS. R. B. Richman (General Electric Co., Richland, Wash.). 13p. (CONF-243-23; HW-SA-3087)

From American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, Oct. 1963.

Neutron fluxes within different energy ranges in a Hanford production reactor were measured during corrosion and film tests. Cobalt (present in aluminum–cobalt and nickel materials), nickel, iron, and titanium were used to measure thermal neutrons (from Co^{60} production) and fast neutrons (from (n,p) production of Co^{58}, Mn^{54}, and Sc^{46}). The success of these measurements demonstrated the usefulness of these materials for neutron monitoring, and further demonstrated the effectiveness of methods developed by Hanford Laboratories for irradiating and handling small foil sam-

ples. Precise measurements from these foils make it possible to quantitatively relate neutron energies and intensities to observed effects on chemical and physical properties of materials. (auth)

8689 SAMPLING FOR LOW CONCENTRATIONS OF AIRBORNE ACTIVITY. R. B. Parker and C. R. Hill. 15p. (CONF-365-4)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

Techniques and equipment used in measuring the radioactivity of aerosols are described. Filtration methods and an electrostatic precipitator are described. Measurements on alpha, beta, and gamma activity are discussed. (P.C.H.)

8690 THE USE OF GEIGER MÜLLER TUBES FOR THE MEASUREMENT OF X AND GAMMA RADIATION UP TO 1 Mev. M. J. Butler and F. L. Veale. 22p. (CONF-365-16)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The energy response of G-M tubes to x and gamma radiation is discussed using the basic shape of the response curve, uncorrected response, and correction of the response curve by filters. The dose response, total dose measurements, and low and high dose rates from G-M tubes are discussed. Some practical applications are presented. (R.E.U.)

8691 DETECTORS USED IN PARTICLE PHYSICS RESEARCH. A. C. Melissines. 10p. (CONF-345-1)

From American Physical Society New York State Section Fall Meeting, Olean, N. Y., Oct. 1963.

Detectors used in particle physics are discussed, and their specific properties are compared. With the "pictorial" devices are included nuclear emulsions, cloud and bubble chambers, and spark chambers. Included in the "digital" devices are counters, e.g., the Geiger counter, scintillation counters, solid-state detectors, Cherenkov counters, and spark counters. Sensitivity, resolving power, time resolutions, saturation level, and energy detection are discussed. (R.E.U.)

8692 FILM PACKET FOR THE EXACT MEASUREMENT OF ENERGETIC RADIATION. Max Wiesner (to Agfa AG). German Patent 1,153,838. Sept. 5, 1963). Filed Feb. 5, 1960.

A film pack adapter is described that is provided with a stamping device. A portion of the adapter that is made of metal or plastics forms the matrix. (Gmelin Inst.)

8693 SOLID STATE RADIATION DETECTOR WITH SEPARATE OHMIC CONTACTS TO REDUCE LEAKAGE CURRENT. Stephen S. Friedland (Solid State Radiations, Inc.). U. S. Patent 3,117,229. Jan. 7, 1964. Filed Oct. 3, 1960.

A solid-state radiation detector that is provided with means for obtaining higher resolution of energy measurements of incident radiation that was previously obtained is described. The surface leakage current bypasses the signal load so that an output signal, which is proportional to the energy of the incident radiation only, is accurately displayed or recorded. Leakage currents that ordinarily flow across the p-n junction surface into the ohmic correction through the load resistor are eliminated from the output signal. The semiconductor consists of a layer of one type of semiconductor material having a resistivity of the order of 1000 ohm-cm and a second layer of another type of semiconductor material having an incident radiation surface and forming a p-n junction with the first layer at a distance within one micron of the incident surface. There is one ohmic contact with the periphery of a surface of the first layer and a second ohmic contact with the surface of the first layer but spaced within the first ohmic contact. (M.C.G.)

ISOTOPE TECHNOLOGY

Industrial Applications

8694 (ORO-612) PREPARATION OF WOOD-PLASTIC COMBINATIONS USING GAMMA RADIATION TO INDUCE POLYMERIZATION. James A. Kent, Anthony Winston, and W. R. Boyle (West Virginia Univ., Morgantown. Engineering Experiment Station). Sept. 1, 1963. Contract AT(40-1)-2945. 88p.

The shear strength and static bending strength of wood-plastic combinations prepared by the use of gamma radiation are superior to those of the corresponding unmodified wood. Removal of inhibitor from vinyl acetate prior to its introduction into wood, and radiation-polymerizing under an inert atmosphere, provides the finished product at a dose of about 0.5 Megarad when the dose rate is 10^5 rad/hr. Methyl methacrylate can be radiation-polymerized in wood under the same conditions at a dose from 1 to 2 Megarads. Hydroxyethyl methacrylate containing a commercial inhibitor is completely radiation-polymerized in white pine and other woods at a dose less than 0.5 Megarad. Screening tests to evaluate the dimensional stabilization of wood by various radiation-polymerized compounds indicate that some improvement is realized when sugar maple is combined with methyl acrylate, tri- and tetraethylene glycol dimethacrylate, butyl acrylate, and others. Extraction of polymers from wood-plastic combinations indicates that there is little if any grafting to the wood substrate. Other measurements disclose that there is a difference between the molecular weights of the polymer formed in the wood and in ordinary bulk polymerization, the former being somewhat higher. Carbon tetrachloride is found to increase the polymerization rate and reduce the dose required to polymerize methyl methacrylate in wood. (auth)

8695 THE LAY-OUT AND DESIGN OF A COBALT-60 γ-IRRADIATION UNIT. H. Kroenert and G. O. Schenck (Max-Planck-Institut für Kohlenforschung, Mulheim, Ger.). Chem.-Ingr.-Tech., 35: 641-7(Sept. 1963). (In German)

A description is given of the lay-out, the various sections, anti-radiation screening, and technical equipment of an underground laboratory, as well as of the safety measures employed with a cobalt-60 γ-radiation unit possessing a maximum activity of 50,000 curies to be used for irradiation on a small scale. Information is given on the methods of assessing the output energy of a radiation source, the intensity of radiation in its immediate vicinity, and the intensity of stray radiations in the labyrinth approach to the irradiation unit. (auth)

8696 AMPLIFICATION EFFECT OF LEAD FOILS IN GAMMA-RAY FILM EXPOSURE. E. Becker (Technische Hochschule Magdeburg, Ger.). Kernenergie, 6: 621-34 (Nov. 1963). (In German)

Systematic investigations were made of the influence of the thickness of lead foils on the amplification factor dependence on the energy of the radiation source and the penetrated material thickness. (tr-auth)

8697 USE OF ISOTOPES IN MAINTENANCE. J. C. Bradbury-Williams. Nucl. Energy, 4-13(Jan. 1964).

The applications of radioisotopes in industrial maintenance procedures in the United Kingdom and legislation governing the procedures and safety precautions involved are summarized. (C.E.S.)

8698 SOME APPLICATIONS OF RADIOISOTOPES IN THE UNILEVER RESEARCH LABORATORY, PORT SUNLIGHT. W. P. Evans. 10p. (CONF-365-14)

From Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, Oct. 1963.

The uses of radioisotopes in the Unilever Research Laboratory are briefly reviewed. Radioisotopes are used both for basic studies in detergency, adsorption and diffusion phenomena, and also for more applied investigations such as removal of dental enamel by abrasion, and paper sizing. (P.C.H.)

Power Application

8699 (HW-78180) HW-76323—"RADIOISOTOPIC HEAT SOURCES" SUPPLEMENTARY DATA. C. A. Rohrmann (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 1, 1963. Contract AT (45-1)-1350. 6p.

On the basis of production feasibility and the need for an isotope separation process, it was determined that of the 32 isotopes with half lives of 100 days to 1 yr only Ce^{144}, Po^{210}, and Cm^{242} held promise as heat sources. Of eleven isotopes with half lives of 100 to 2000 yr, only Am^{241} shows promise for economical production. It is estimated that with large-scale Pu recycle, Am^{241} would cost $200/gr. The forty-three isotopes are listed, and the characteristics of the twelve most promising heat source candidates are tabulated. (D.C.W.)

8700 (NYO-10689) A BIBLIOGRAPHY ON RADIOISOTOPE POWER SUPPLIES. Daniel M. Axelrod and Joseph P. Novarro (New York Operations Office, AEC). Aug. 1963. 30p.

A bibliography is presented of reports on the research and development and space and terrestrial applications of radioisotope-fueled power supplies. (C.E.S.)

Separation and Production

8701 (SGAE-B-CH-2/1963) RAPID PREPARATION OF CARRIER-FREE I-131 FROM NEUTRON-IRRADIATED TELLURIC ACID. H. Sorantin, H. Bildstein, and B. Bauer (Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Vienna). Sept. 1963. 16p.

Carrier-free I^{131} is prepared from neutron-irradiated telluric acid by dissolving the latter in weak hydrochloric acid and precipitating it with ethanol. The I^{131} containing filtrate is made absolutely tellurium-free by passing it over a column of chromatographic grade alumina: yields of 60 to 65% are obtained. Another 20% can be eluted also carrier-free from the column by 0.01 to 0.1N ammonia, giving an overall yield of 80 to 85% of the present I^{131}. (auth)

8702 THE SEPARATION OF PLUTONIUM ISOTOPES. R. W. McIlroy (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 283-305(1963).

The theory of isotope separation processes and the performance of the Oak Ridge "calutrons" and A.E.R.E. "Hermes" are discussed. The chemical processes necessary in the recovery and purification of the isotopes are also discussed. (R.E.U.)

8703 INTERFACE PROPERTIES OF PACKINGS FOR COUNTER-CURRENT DISTILLATION. Erich Krell. Wiss. Z. Tech. Hochsch. Chem. Leuna-Merseburg, 5: No. 1, 35(1963). (In German)

A significant effect of the geometric form and roughness on the contact angle was found in investigations on the process of wetting. The contact angle can also be lowered by oxidation in the case of metallic packings and by irradiation with γ rays or η in the case of polymeric packings. A 12–30% improvement in separation efficiency for distillation of isotopes was obtained. (TCO)

8704 DISTILLATION OF HYDROGEN ISOTOPE MIXTURES. INDUSTRIAL MANUFACTURE OF DEUTERIUM WITH LOW TRITIUM CONTENT. A. Coulon, G. A. Simonet, and L. Stouls (CEA, Paris). p.45-63 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962. (In French)

With the practical view to obtain deuterium containing as little as possible tritium, the relative separation, through fractional distillation at low temperatures, of the different isotopes of hydrogen was studied. The studies and experiments made had to change the arrangement of distillation columns to obtain deuterium suitable for bubble chambers. The separation process and the results, the equipment, sampling processes, and analytical methods are reported. (auth)

8705 BORON METAL PLAN (Engineering Materials). (New York Operations Office. Health and Safety Lab., AEC). (CAPE-1025)

This package contains 126 units. An ether complex of BF_3 is used as feed in a plant that produces 500 kg/year of boron (95% B^{10}) via the following steps: isotope separation, electrolytic reduction, and hydrogen-hot wire reduction. (D.E.B.)

MATHEMATICS AND COMPUTERS

Refer also to abstract 8919.

8706 (IS-765) SCANF MACRO FOR THE IBM 7070/2/4. T. R. Johnston (Ames Lab., Ames, Iowa). Nov. 1963. Contract W-7405-eng-82. 16p.

The SCANF MACRO, which provides an easy means of scanning a core area defined by a record definition word and of determining the type of entities and their context, is described. The entities must be in alphanumeric form. (auth)

8707 (IS-769) POGO REFERENCE MANUAL. D. R. Fitzwater, E. H. Hietbrink, M. M. Ledet, D. E. McFarland, and C. E. Runge (Ames Lab., Ames, Iowa). Nov. 1963. Contract W-7405-eng-82. 54p.

The necessary background information for the use of the various system functions is presented, together with program descriptions for each system function and examples of their use. (auth)

8708 (SLAC-22) ON N-DIMENSIONAL TAYLOR AND LAGRANGE OPERATORS. K. G. Dedrick and E. L. Chu (Stanford Univ., Calif. Standard Linear Accelerator Center). Nov. 1963. Contract AT(04-3)-400. 33p.

The coordinate transformations and Jacobians involved in the Lagrange and Taylor theorems are treated, and the theorems and associated operators are described. Relations are established between the Jacobian and the Lagrange and Taylor differential operators. Some applications of the relations are considered. (D.C.W.)

8709 (TID-19993) COMPUTER RESEARCH AND DEVELOPMENT. Technical Progress Report which covers the period to December 1, 1963. (Chicago. Univ. Inst. for Computer Research). Includes Appendices: I. THEORY OF ADAPTIVE PATTERN RECOGNITION. H. M. Martinez. II. ANALYSIS OF A NATURAL LANGUAGE. T. Hofmann. III. A SYNTAX-STRUCTURED COMPILER. Herbert Kanner, Paul R. Kosinski, and Charles L. Robinson. IV. A TREE-STRUCTURED SYMBOL TABLE FOR AN ALGOL COMPILER. P. Kosinski, H. Kanner, and C. Robinson. V. AN EFFICIENT STRUCTURE FOR COMPILED ALGOL 60 PROGRAMS. Charles L. Robinson, Herbert Kanner, and Paul Kosinski. 34p. Contract AT (11-1)-614.

The Maniac III computer operated with an availability of about 70% of its promised time. Among the most significant developments were the operation of the first magnetic tape unit, the operation of the spark chamber on-line into the computer, and the completion of two sets of buffer registers. Additionally one-pass and two-pass ALGOL-60 compilers were developed for Maniac III and for the CDC 3600. Error monitoring, error propagation in recurrence relations, theory of adaptive pattern recognition, and computer analysis of natural language were investigated. Reduction of bubble and spark chamber data was also performed. (D.C.W.)

8710 (WAPD-BT-29(p.81-5)) SOME COMMENTS ON THREE-DIMENSIONAL ALTERNATING DIRECTION METHODS. W. H. Guilinger, Jr., and R. B. Kellogg (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

A family of three-dimensional alternating direction iterative methods is presented which includes some known methods as special cases. Some sufficient conditions for convergence are given, and an example is presented to show that divergence may take place with a single positive acceleration parameter. (auth)

8711 COMPUTER CALCULATION AND DISPLAY OF ABSORPTION AND DERIVATIVE CURVES OF GAUSSIAN AND LORENTZIAN FUNCTIONS. W. A. Young (Atomics International, Canoga Park, Calif.). J. Appl. Phys., 35: 460-1(Feb. 1964).

Two Fortran II programs were developed for use with IBM-709, -7090, or -7094 digital computers to calculate and display, using SC-4020 automatic display equipment, absorption and/or derivative curves using Gaussian and/or Lorentzian line shapes. (C.E.S.)

METALS, CERAMICS, AND OTHER MATERIALS

General

8712 (BMI-1651) POSTIRRADIATION RELEASE OF Xe^{133} FROM OXIDE CERAMICS. David L. Morrison, Thomas S. Elleman, Duane N. Sunderman (Battelle Memorial Inst., Columbus, Ohio). Oct. 17, 1963. 14p. Contract W-7405-eng-92.

Postirradiation measurements were made at 700 to 1500°C of the release of Xe^{133} recoiled into alpha Al_2O_3, BeO, MgO, and ZrO_2 during neutron irradiation in contact with UO_2 powder. The release pattern from most of the specimens was identical: a high rate of loss of Xe^{133} for several minutes followed by a slower release for which the cumulative fractional release was linear with the square root of the heating time. Diffusion coefficients for Xe^{133} were calculated from the slope of release curve following the burst. The magnitude of the diffusion coefficients was nearly the same for all of the materials studied, and the activation energy for Xe^{133} release from alpha Al_2O_3 above 1000°C was found to be 64 kcal per g mole. The xenon release behavior was compared to anion diffusion in these oxides. (auth)

8713 (BMI-1658) PRODUCTION URANIUM RESIDUAL STRESSES, INTERNAL FRICTION, AND MODULUS. Ellis L. Foster, ed. (Battelle Memorial Inst., Columbus, Ohio). Dec. 27, 1963. Contract W-7405-eng-92. 40p.

Levels and distribution of residual stresses in specimens representative of six normal steps in manufacture of hollow uranium fuel elements, and four alternative steps, were determined. To obtain the data, an electrochemical procedure was developed and used for the rapid and controlled removal of metal from the bores of the specimens. A definite correlation was noted between residual-stress level and specific manufacturing process steps. Distinct differences in residual stresses were noted between oil- and water-quenched specimens, those in the latter being in the 60,000-psi range while oil-quenched specimens showed about one-fifth of this stress. In the final production step, the canning procedure, however, the effects of earlier stressing are almost completely canceled, final stresses being in the 15,000- to 20,000-psi range. In measurements after various mechanical and thermal treatments, internal friction and Young's modulus went through a maximum and minimum, respectively, with increasing severity of quenching from a beta temperature. Uranium beta heat treated and furnace cooled, when cold reduced, exhibited monotomic increases and decreases, respectively, in internal friction and modulus for reductions up to 12 per cent. Uranium which was hot forged and rolled and then cold reduced in increments up to 46 per cent in area showed a rapid reduction in modulus with increasing degree of cold work, which then leveled off; the internal friction fluctuated, showing no relationship to degree of working. (auth)

8714 (BNL-836) HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. A Bimonthly Technical Progress Review, Volume 1, Number 5. (Brookhaven National Lab., Upton, N. Y.). Oct. 1963. Contract [AT(30-2)-Gen-16]. 81p.

Reviews are presented of 47 papers, of which 23 are the published papers presented at the Third Annual High-Temperature Liquid-Metal Heat Transfer Technology Conference held at ORNL on Sept. 4 to 6, 1963. Tables of brief summaries of research programs on the physical properties, heat transfer technology, and corrosion properties of liquid metals are also given. (D.L.C.)

8715 (CEND-186) THE DEVELOPMENT AND TESTING OF UO_2 FUEL SYSTEMS FOR WATER REACTOR APPLICATIONS. Summary Report, June 15, 1962–July 31, 1963. B. E. Murtha and W. P. Chernock (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Dec. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2863. 124p. (EURAEC-904)

The fabrication of reactor fuel elements containing vibratory compacted uranium dioxide is studied. It is shown that with economical powder size selection and high impact vibrators, densities of 89% of theoretical can be achieved in 3- and 6-foot fuel lengths. A thirty-seven tube projection welded cluster was compacted to an average density of 84.8% of theoretical. A series of mechanical strength tests to determine the tensile, shear, and torsional resistance of the individual welds of projection welded clusters indicate that the joints have good ductility and are primarily limited by the tensile strength of the spacer wires. A Zircaloy cluster welded in air showed high corrosion rates; therefore further specimens will be welded by flooding with inert gas. Thermal testing of the fuel elements is being continued. (N.W.R.)

8716 (CONF-339-5) URANIUM–ALUMINUM ALLOY POWDERS FOR USE AS NUCLEAR REACTOR FUELS. G. W. Gibson and D. R. deBoisblanc (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). [nd]. Contract AT(10-1)-205. 12p.

From the Metallurgical Society of A.I.M.E. Fall Meeting, Cleveland, Oct. 1963.

The trend toward higher fuel densities in reactor cores is noted. The use of powdered U–Al intermetallic compounds would provide the desired high fuel densities with a minimum of fabrication troubles, and burnable poisons can be added. The properties of U and U–Al compounds are described; UAl_2 and UAl_3 appear to be the most attractive fissile dispersants in dispersion-type fuel elements. Plates of Al–UAl_3 were fabricated and irradiated along with Al–U_3O_8 plates. The results showed that the Al–UAl_3 plates were more stable than the Al–U_3O_8 plates. (D.L.C.)

8717 (DMIC-186) THE EFFECT OF FABRICATION HISTORY AND MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF REFRACTORY METALS AND ALLOYS. A. G. Imgram and H. R. Ogden (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). July 10, 1963. 64p. (AD-423952)

The relationships between fabrication history, microstructure, and the mechanical properties of refractory metals and alloys depend on factors such as grain size and shape, second-phase distribution, and impurity content and location. The characteristic behavior of alloys strengthened by dispersions differs from that for alloys strengthened by solid-solution alloying. Dispersion-forming alloy additions increase strength and resistance to recrystallization. Furthermore, their grain-refining effect generally results in a lowering of the ductile-to-brittle transition temperature. Solution-annealing and aging heat treatments can often refine the dispersion

distribution and lead to greatly improved strength. This ability to alter the dispersion distribution makes this type of alloy quite sensitive to fabrication history. Solid-solution alloying additions also increase the strength and resistance to recrystallization. Although the strengthening effects of solid-solution additions can be retained to much higher temperatures than is generally the case with dispersion additions, they usually impair the ductility. Large working reductions considerably increase the strength and lower the ductile-to-brittle transition temperature. Both dispersion and solid-solution-strengthening additions increase work-hardening rates. Interstitial impurities can greatly increase the ductile-to-brittle transition temperature of unalloyed refractory metals and of solid-solution-strengthened alloys and are not greatly beneficial to strength and resistance to recrystallization. An interstitial content close to the stoichiometric ratio with compound-forming reactive-metal additions is necessary to realize the full strengthening potential. (auth)

8718 (DMIC-Memo-183) THE CURRENT STATUS AND 1970 POTENTIAL OF SELECTED DEFENSE METALS. (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Oct. 31, 1963. Contract AF33 (616)-7747. 45p. (AD-425604)

A brief review is presented of the current status and future potential (1970) of a selected number of metals and their alloys. These metals include Be, Co, Nb, high-strength steels, Mo, Ni, stainless steels, Ta, Ti, W, and coatings for refractory metals. (D.L.C.)

8719 (EURAEC-746) PHYSICAL PROPERTIES OF UO_2 SINGLE CRYSTALS. Quarterly Report No. 6, March 1–June 30, 1963. (Centre d'Étude de l'Énergie Nucléaire, Mol, Belgium). Work Performed under United States–Euratom Joint Research and Development Program. Contract 063-61-10-RDB. 36p.

Several runs have been made to prepare single crystals of UO_2 for studies of the physical properties. A new method has been developed allowing the preparation of single crystalline material with compositions between UO_2 and U_4O_9. Calculated amounts of UO_2 and U_3O_8 are held in oxygen equilibrium at 1400°C for 2 hours. Improvements of the experimental techniques allowed the observation of sintering above a temperature of 1700°C. Concerning the study of self-diffusion of U in UO_2, work has been done on the development of a method for the plane-parallel removal of layers of UO_2. Precipitates of U_4O_9 of various different shapes have been studied in crystals with O/U ratio of 2.006 to 2.01. Fission fragment damage in as grown crystals (O/U = 2.006) and in stoichiometric crystals was observed after slight irradiations (up to 10^{16} nvt). The irradiations were carried out at 20°C and at higher temperatures. The thermoelectric power of a few crystals of different excess oxygen content has been determined as a function of temperature (100 to 600°K). The electrical conductivity of single crystals of UO_2 with O/U ratios of 2.000 to 2.06 has been measured after successive periods of exposure (up to 1.6×10^{17} thermal neutrons/cm^2). The conductivity of the oxidized crystals decreases markedly upon irradiation and reaches a saturation value at about 4×10^{15} fissions per cm^3, whereas the conductivity of the stoichiometric specimen remained practically unchanged up to 1.6×10^{16} fissions per cm^3. A study has been made of the validity of the Low, Lee, and Pine's method in the case of the interaction of an electron with a single lattice oscillator. The results of this study are reviewed. A few remarks are given about the conduction mechanism in uranium dioxide. Measurements of the thermal conductivity from liquid helium temperature to about 200°K and at 290°K indicate the existence of a minimum value at about 180°K. (auth)

8720 (GEAP-4408) A URANIUM DIOXIDE FUEL ROD CENTER MELTING TEST IN THE VALLECITOS BOILING WATER REACTOR. H. E. Williamson and J. P. Hoffmann (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Nov. 15, 1963. Contract AT(04-3)-189. 56p.

The conditions that will cause UO_2 melting were investigated by a calibration test conducted in the VBWR. The central portion of the 3.15-cm-diameter uranium dioxide fuel column melted. It appears that the UO_2 was molten out to a radius of 1.22 cm in the peak power region. The maximum extent of melting probably occurred during the peak power run when the $\int_{T_0}^{T_c} k dT$ in this region of the rod reached 171 watts/cm. The estimated radius of melting from metallographic examination indicates the $\int_{T_0}^{T_m} k dT$ for sintered UO_2 in 89 watts/cm. This supports a calculated estimate for sintered UO_2 thermal conductivity published by D. R. deHalas and G. R. Horn. The results of the previous calibration run and subsequent experimental data by Lyons are also consistent with this value. The conclusion is contingent on the interpretation of the postirradiation crystal structure of the UO_2. Insufficient data are available on the mechanisms by which various UO_2 crystal structures are formed to permit a positive identification of the extent of melting and correlation with time of operation. No conclusion can be drawn as to whether the thermal conductivity of the UO_2 changed with operation. Although extensive UO_2 melting occurred, there was no indication of fuel rod clad failure. Axial heat transfer by convection in the molten UO_2 was significant. (auth)

8721 (HW-78388(p.5.1-22)) FUELS STUDIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Tests were made of ceramic fuels. Melting points were determined for plutonium borides. The absorption spectra for single-crystal and polycrystalline UO_2 were measured between 0.6 and 15 μ. Vaporization rates for plutonium oxides were determined. Three Th-2.35 wt % U^{235}–1 wt % Zr alloy fuel elements completed their third cycle of irradiation accumulating 2400 Mwd/ton exposure. Thorium contamination was found to have a detrimental effect on the corrosion resistance of Zircaloy-2 to 5 wt % Be braze. Th–2.5 wt % U–1.0 wt % Zr rods were coextruded to 0.525 in. diameter to prepare autoclave test specimens. Pneumatic impaction methods are being developed for fabrication of W–UO_2 cermets and plutonium-containing materials. Single rods were loaded with UO_2 to 86 to 89% TD on a prototype vibrational compaction facility. EBWR-type fuel was impacted to 98.9% TD by improved pneumatic impaction techniques. Fuel element rejuvenation was accomplished by opening the irradiated fuel rod and compacting enriched UO_2 into a zirconium tube positioned concentrically along the rod axis. Radial flow thermal conductivity measurements were made on tungsten-plated UO_2 between 800 and 1800°C. In-reactor measurements were made of the thermoelectric potential of UO_2. Thin wafers of Pu-15 wt % Zr imbedded in UO_2 pellets oxidized but did not diffuse on heating. The irradiation performance of MgO–PuO_2 and PuO_2–UO_2 fuels was studied. Stainless steel–PuO_2 cermets were prepared by pneumatic impaction. A depleted-uranium fuel element is being developed for use in the blanket of a fast reactor and then in the core of a thermal reactor without intervening separation and refabrication processes. Satisfactory irradiation per-

formance was demonstrated with Zircaloy-2-clad Al–Pu–Ni alloy fuel rods, fabricated by pneumatic injection casting. Fuel elements are being developed and tested for the Plutonium Recycle Test Reactor. (M.C.G.)

8722 (HW-78549) DETERMINATION OF URANIUM IN WELDS ON ZIRCONIUM-CLAD FUEL ELEMENTS. G. F. Garlick (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 30, 1963. Contract AT(45-1)-1350. 12p.

An analysis is shown of beta particle detection to determine uranium inclusion in the welds to zirconium cladding of fuel elements. Equations derived may be used to determine the detection sensitivity for various weld sizes and percentage of uranium present. In applying specific formulas, the sample calculated may be used as a guide. If the requirements on sensitivity are as severe as used in the sample calculation, the background count will probably have to be subtracted out to obtain usable data. Even then, with these requirements, the beta particle monitoring approach will be only marginally successful. (auth)

8723 (IDO-16934) ANNUAL PROGRESS REPORT ON FUEL ELEMENT DEVELOPMENT FOR FY 1963. G. W. Gibson, M. J. Graber, and W. C. Francis (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Nov. 25, 1963. Contract AT(10-1)-205. 63p.

Progress in fuels and materials development is reported. Irradiation tests on powdered UAl_3 intermetallic compounds demonstrated good stability and fission gas retention capabilities. Developmental aluminum powder metal products showed good corrosion resistance at high temperatures while retaining excellent high temperature strength. All of the fuel compositions tested (UO_2, U_3O_8, and UAl_3 in aluminum matrices) exhibited density decreases under irradiation. Tensile tests on sandwich-type fuel plates at elevated temperatures indicated that the fuel plate strength is strongly influenced by the core material rather than dependent primarily on the cladding material as was found true of lower (MTR) temperatures. Three capsules containing beryllium were inserted in the ETR, in order to determine strength, gas release, and growth during a high-temperature (600–800°C) irradiation. An MTR fuel element employing advanced metallurgical techniques to optimize the hydraulic and heat transfer characteristics was fully irradiated in the MTR. The fuel element consisted of 32 plates containing 250 g U^{235} in a U_3O_8–Al dispersion. A prototype ETR fuel element was made without side plates. (M.C.G.)

8724 (IS-722) CARBIDES. William A. Frad (Ames Lab., Ames, Iowa). Aug. 1963. Contract W-7405-eng-82. 94p.

Results are presented of a general survey covering the literature published on carbides. Nonmetal carbides such as C_2N_2, CO, CS_2, CCl_4, etc., are not included. The material is organized on the basis of the families of elements in the periodic chart of the atoms. Data concerning formulas, composition ranges, preparation, and crystal structure are presented. Temperature ranges of structure stability for carbides having more than one crystal form are included in a number of cases. Key references are cited. (auth)

8725 (NMI-2123) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report, November 1963. (Nuclear Metals, Inc., West Concord, Mass.). Jan. 10, 1964. Contract AT(30-1)-2784. 57p.

Three sections are presented which deal respectively with the fabrication of W and W–Re tubing, single-crystal deformation in zone-refined Be, and development of uranium SLIS alloys. Separate abstracts were prepared for all three sections. (D.L.C.)

For abstracts of individual sections see: 8726, 8771, and 8796.

8726 (NMI-2123(p.47-51)) DEVELOPMENT OF URANIUM SLIS ALLOYS. A. L. Geary (Nuclear Metals, Inc., West Concord, Mass.).

Results of chemical analyses of splatcooled U–Cu, U–Be, and U–Ag alloys are given which show that the compositions of U–Be and U–Ag are below the intended values, and that some carbon is picked up in the melting of U–Be. Studies of the precipitate phases in aged U–0.2 wt % Be and Zircaloy-2–1.1 wt % Be alloys are reported. (D.L.C.)

8727 (ORNL-TM-740) STRESS-INDUCED RELEASE OF FISSION GASES FROM UO_2 AND ThO_2–UO_2. R. B. Fitts, J. L. Scott, and C. S. Morgan (Oak Ridge National Lab., Tenn.). Jan. 28, 1964. Contract W-7405-eng-26. 9p.

A preliminary investigation of the influence of applied stress on fission-gas release from irradiated UO_2 and ThO_2–UO_2 specimens was made. Application of stress after the specimen was brought to temperature and a relatively steady release rate was reached resulted in enhancement of the postburst release rate. The possibility of dislocation motion contributing to the fission-gas release is considered. (auth)

8728 (UCRL-7252-T(Rev.I)) SUMMARY OF BeO RESEARCH AT LAWRENCE RADIATION LABORATORY, LIVERMORE. Carl F. Cline, comp. (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 26, 1963. Contract W-7405-eng-48. 18p.

Brief summaries are presented of the status and plans of 17 research programs completed or being conducted on BeO. Among the topics studied are crystal growth and properties, radiation damage, microhardness, microstructures, diffusion, electrical properties, cleavage, mechanical properties, optical properties, and sintering. (D.L.C.)

8729 (UNC-5074) OUT-OF-PILE PROPERTIES OF MIXED URANIUM–PLUTONIUM CARBIDES. Final Report. D. Stahl, A. Strasser (United Nuclear Corp. Development Div., White Plains, N. Y.); K. Taylor, and J. Anderson (Carborundum Co., Niagara Falls, N. Y.). Dec. 6, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3118. 68p. (EURAEC-918)

Fabrication studies to produce high density solid solutions of 80% UC–20% PuC, with reproducible structure, composition, and density, were completed. Solid solution (U,Pu)C powder was produced by the oxide-carbon reaction, and the powders were consolidated by cold pressing and sintering. The studies were a continuation of work performed on Contract AT(30-1)-2899 with the USAEC. Two types of material were produced: 1. $(U_{0.8}Pu_{0.2})C_{0.95}$, single-phase monocarbide pellets with average densities of 12.8 g/cm^3 (94% of theoretical), sintered at 1925°C; 2. $(U_{0.8}Pu_{0.2})C_{0.95}$ + 0.1 wt % Ni sintering aid, major monocarbide phase and minor amount of sesquicarbide phase pellets, with average densities of 13.1 g/cm^3 (96.5% of theoretical), sintered at 1550°C. The coefficient of thermal expansion was measured as 11.9×10^{-6}/°C for $(U_{0.8}Pu_{0.2}) \times C_{0.95}$ at 25 to 1400°C and 12.3×10^{-6}/°C for $(U_{0.8}Pu_{0.2})C_{0.95}$ + 0.1 wt % Ni at 25 to 1400°C. The presence of the nickel

sintering aid did not make a significant difference. The values are similar to those of UC, compared at 950°C, the maximum temperature to which UC has been measured. The melting point of $(U_{0.8}Pu_{0.2})C_{0.95}$ was found to be 2480 ± 20°C. The solidus is estimated to be about 2430°C. The vapor pressure data in the temperature range of 2100 to 2600°K show that the pressure of plutonium is about the same as uranium over $(U_{0.8}Pu_{0.2})C_{0.95}$. While the uranium data are about an order of magnitude higher than anticipated, based on data for U over UC (probably due to carbon diffusion across the cell), the thermal stability of the fuel in the temperature range of power reactors is still quite good. Thermal conductivity capsules containing $(U_{0.8}Pu_{0.2}) \times C_{0.95}$, $(U_{0.8}Pu_{0.2})C_{0.95}$ plus 0.12 wt % Ni, and UC plus 0.12 wt % Ni (standard) were fabricated. Repairs required by the Mound Laboratory equipment have delayed the measurements. $(U_{0.8}Pu_{0.2})C_{0.95}$, with and without nickel sintering aid, was compatible with type 316 stainless steel, niobium, niobium–1% zirconium, 2¼ Cr–1 Mo steel, and vanadium at 593°C and 816°C for 1000 and 4000 hr. There was no reaction with Inconel-X after 1000 hr at 593°C, but there was a slight reaction after 1000 hr at 816°C. A reaction was noted with Zircaloy-2 after 1000 hr at both 593° and 816°C. The results were similar to those obtained with UC under AEC Contract AT(30-1)-2899. (D.L.C.)

8730 (WADC-TR-58-360(Pt.V)) INVESTIGATION OF ELASTIC AND THERMAL PROPERTIES OF CARBON-BASE BODIES. S. Mrozowski, J. F. Andrew, N. Juul, S. Sato, H. E. Strauss, and T. Tsuzuku (New York. State Univ., Buffalo). Sept. 1963. Contract AF33(616)-7791. 75p.

In continuation of the work on elastic properties of carbons, using the greatly improved high temperature equipment, families of curves of the dependence of Young's modulus on temperature and on the heat treatment were obtained for four basic types of carbons and as far as possible, for a number of special types of commercial carbons. The amplitude dependence of internal friction and dynamic Young's modulus were investigated in the sonic range for a number of types of carbons as made and also neutron irradiated, as well as the temperature dependence of internal friction of the resonance frequency from room down to liquid hydrogen temperature. The presence of a Bordoni peak at 50°K was found to be connected with the relaxation of motion of dislocations. Families of curves of the dependence of heat conductivity and electric resistivity on temperature and on the heat treatment were obtained for four basic types of carbons, using an improved technique. The "steady" sinusoidal wave technique for determination of heat diffusivity was improved in precision and extended in temperature range and data collected for several types of graphitized materials. (auth)

8731 (EURAEC-510) STUDY OF THE INFLUENCE OF OXYGEN ON THE MECHANICAL PROPERTIES OF WELDS MADE USING THE ELECTROSLAG PROCESS. Special Report No. 1. (Chantiers de l'Atlantique Penhoet-Loire, Paris). Dec. 11, 1962. Work Performed under United States–Euratom Joint Research and Development Program. Contract 054-61-12 RDF. 44p. (A translation)

The impact strength of welds made in Mn–Mo steel using the electroslag process was studied under different welding conditions to determine possible effects of slag pool oxidation. It was found that the use of argon blanket had a favorable effect on the impact strength. (D.L.C.)

8732 (EURAEC-566) PLUTONIUM RECYCLING. Quarterly Report No. 4, 62(Q.8), October 1–December 31, 1962. (France. Commissariat à l'Énergie Atomique, Paris). Work Performed under United States–Euratom Joint Research and Development Program. Contract 037-62-12 RDF. 15p. (A translation)

The electric conductivity of plutonium dioxide–uranium dioxide systems and the fabrication of plutonium–uranium alloy fuel elements are discussed. (N.W.R.)

8733 (EURAEC-734) SINTERED URANIUM OXIDE. SINTERING TECHNIQUES—BEHAVIOR UNDER IRRADIATION. Quarterly Report No. 11, April 1 to June 30, 1963. (France. Commissariat a l'Energie Atomique, Paris). Work Performed under United States–Euratom Joint Research and Development Program. Contract 031-60-10 RDF. 42p. (A translation)

UO_2 pellets obtained from highly reactive powders by slow sintering at 1400°C or by accelerated sintering at 1650°C were compared with samples sintered by the industrial process which has been developed under this same contract. The comparison is based on the study of the increase in grain size during extended thermal treatments at 1400, 1600, and 1800°C. The average size of the grains after annealing for 128 hours at 1800°C was found to be 20 μ for the laboratory samples, and 25 μ for the industrial pellets, respectively. It has been demonstrated previously that an x-ray analysis of the structure of the superficial layers of the sintered UO_2 clearly shows that a very slight oxidation occurs at a low temperature. This phenomenon was investigated more thoroughly: on the one hand, by controlled oxidation at a low temperature, and on the other hand, by successive abrasions of thin layers of the samples subjected to oxidation. The results obtained to date seem to indicate that these formations are of the same type as those which develop on UO_2 powders in similar conditions; however, it is quite probable that the mechanism is different. Tentative measurements of very thin surfaces were carried on by using adsorption of marked xenon. The method for preparing Xe^{133} by using hydridization of irradiated uranium leads to a mixture of Xe, H_2, and He in which a thorough separation of xenon presents considerable difficulties which have not yet been solved, whereas by melting irradiated uranium the desired result can be obtained. The "Medicis" experiment has been inserted into the pile. Two types of capsule have been tested: one bringing the UO_2 samples up to a temperature of 1400°C, the other allowing a temperature of 2000°C to be reached by means of a h-f furnace. The preliminary tests being satisfactory, a sample of 50 mg of UO_2 was progressively brought under flux to a temperature of 2000°C; the fission gases released during this experiment were collected and analyzed. (auth)

8734 (EURAEC-735) QUARTERLY REPORT NO. 4 [ON PROPERTIES OF STAINLESS STEELS], APRIL 1 TO JUNE 30, 1963. G. Chaudron. Work Performed under United States–Euratom Joint Research and Development Program. Contract RDF 085-62-7. 35p. (A translation)

The structural and chemical properties of stainless steels are compared. Results concerning the measurements of the carbon contents are given. The micrographs obtained by magnetic colloid techniques make it possible to materialize the distribution of the co-existent phases (austenite and martensite). The Debye-Scherrer diagrams recorded on steel No. 3 (18/8 steel of high purity) did not reveal the presence of austenite. The electrochemical study (tracing of the curves I = f(V)) of steels immersed in sulfuric acid shows the influence of structure on the shape of the current-potential curves. Corrosion tests in

steam (400°C, 110 kg/cm^2) were made in the autoclave. (auth)

8735 (EURAEC-782) EXAMINATION OF THE EFFECTS OF NEUTRON IRRADIATION ON THE PROPERTIES OF ZrNb3Sn1 ALLOY. Quarterly Report No. 4, April 1 to June 30, 1963. (Metallgesellschaft A. G., Frankfurt am Main). July 23, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 092-62-7 RDD. 23p. (A translation)

The effects of neutrons on the mechanical properties and corrosion behavior of ZrNb3Sn1 alloy are examined in experiments in a swimming-pool reactor. The irradiation in the reflector position of the reactor was concluded, and a start was made with the irradiation of samples in a core position. Measurements of the spatial and energy distribution of the neutron flux were taken in the core position. An irradiation experiment, using a test autoclave, showed that with the proposed form of construction for the irradiation autoclaves, no inadmissible heating from γ radiation is to be expected in the corrosion experiments. The mechanical and metallographic examination of the nonirradiated samples was continued. The corrosion samples, without irradiation, attained a running time of over 2,000 hours. (auth)

8736 (EURAEC-859) DIFFUSION OF FISSION GASES IN NUCLEAR FUELS. Quarterly No. 12, April 1 to June 30, 1963. (Hahn-Meitner-Institut fur Kernforschung, Berlin). July 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 94-62-9 RDD. 15p. A translation of EU-B-25.

A high-frequency heating apparatus for measuring diffusion under vacuum or inert gas atmospheres is described. The carbon content of UC samples was determined, and metallographic micro-sections were prepared. In the CaF_2/Ar system, a higher neutron irradiation resulted in decreasing diffusion coefficients. The activation energy for the diffusion of Xe in UO_2 sintered spheres was determined to be 53 kcal/mole at 800 to 1,450°C. The Xe yield from polycrystalline UC comes from the overlapping of several single release processes. From the Xe yield from ThO_2 crystals, cultivated from a sodium tetraborate melt, the activation energy was estimated to be 96.5 kcal/mole in the 1,400 to 1,800°C range. Above 1,400°C the Xe yield tends toward a lower threshold value than the total activity would seem to indicate. (auth)

8737 STEELS FOR GAS-COOLED REACTOR PRESSURE VESSELS; A REVIEW OF BRITISH PRACTICE. B. Watkins and A. Cowan (United Kingdom Atomic Energy Authority, Culcheth, Lancs, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 55-88(1963).

The problems encountered in the use of steels for gas-cooled reactor pressure vessels are reviewed. Particular attention is given to those properties, e.g., brittle fracture and high-temperature deformation, which are likely to cause operational restrictions. Possible advantages of higher strength steels are discussed. (auth)

8738 THE PREPARATION OF $UO_2 \cdot PuO_2$ POWDERS FOR NUCLEAR FUELS: A REVIEW OF WORK CARRIED OUT IN THE CHEMISTRY DIVISION, A.E.R.E., HARWELL. R. G. Sowden, R. Ainsley, and G. N. Stockdale (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 347-70(1963).

Work carried out on the preparation of $UO_2 \cdot PuO_2$ powders by way of co-precipitation from mixed nitrate solutions is described. Continuous co-precipitation with ammonia from U(VI)Pu(IV) solution constitutes a versatile method of preparing powders that sinter to a high density, but these ADU-type precipitates have poor handling properties. Alternative techniques are surveyed, particularly in relation to plutonium contents of 15 per cent and higher; co-precipitation with oxalic acid from U(IV)Pu(III) solution emerges as the most attractive alternative process. (auth)

8739 MODES OF OPERATION OF AN ELECTRON BEAM FLOATING ZONE MELTING FURNACE: GROWTH OF SINGLE CRYSTALS OF METALS AND ALLOYS. Heinz G. Sell and Willard M. Grimes (Westinghouse Electric Corp., Bloomfield, N. J.). Rev. Sci. Instr., 35: 64-8 (Jan. 1964).

An electron beam melting furnace constitutes a dynamic high-vacuum diode that has theoretically six modes of power regulation as a consequence of the current-voltage characteristic of the furnace and the choice between constant-current or constant-voltage control. Among the six possible modes, three are unstable and three are useful. Preference is given to constant-current control as this is more efficient than constant-voltage control and has the added advantage of an electrothermal feedback loop that increases the stability of regulation. A single tube constant-current regulator is described that utilizes tungsten filament lamps in the feedback loop. This regulator was incorporated in the power system of an electron beam melting furnace. Numerous single crystals of tungsten, other metals, and alloys were grown. The performance of the furnace and the quality of the crystals are discussed. (auth)

8740 PURER METALS. Lectures Delivered at the Institution of Metallurgists Refresher Course, 1961. London, Iliffe Books Ltd., 1962. 113p.

Four lectures delivered at the Fifteenth Annual Refresher Course of the Institution of Metallurgists held at Llandudno in the autumn of 1961 are presented. Topics covered include: technological advances in the production of purer metals, preparation of pure metals, properties of pure metals, and the engineering demand for purer metals. (M.C.G.)

8741 REFRACTORY METAL ALLOYS AND THE PRODUCTION THEREOF. (to National Lead Co.). British Patent 942,019. Nov. 20, 1963. Priority date Feb. 11, 1959, United States.

A consumable electrode is described for use in an electric arc furnace for the production of homogeneous refractory-metal alloy ingots. The electrode is formed of a solid compact of discrete particles of sponge Zr metal and 1.27 to 1.59% Sn, 0.12 to 0.14% Fe, 0.08 to 0.13% Cr, and 0.03 to 0.07% Ni uniformly distributed throughout the compact. The refractory metal is Ti, Zr, Mo, V, Hf, or W. Examples are given. (R.E.U.)

8742 IMPROVEMENTS IN OR RELATING TO NICKEL ELECTROPLATING. Louis Facquet, Jacques Daboval, and Guy Chauvin (to Commissariat a l'Energie Atomique). British Patent 942,832. Nov. 27, 1963. Priority date Mar. 22, 1960, France.

An electrolytic nickel-plating bath is described that allows the production of continuous pure deposits, containing neither boron nor carbon. The aqueous solution contains a nickel salt and an aluminum alum. Nickel chloride, potassium alum, and nickel sulfate are used in examples of the process. (R.E.U.)

8743 PROCESS FOR RENDERING NIOBIUM AND NIOBIUM BASE ALLOYS RESISTANT TO OXIDATION.

Ernst Adalbert Pokorny (to Societe Generale Metallurgique de Hoboken). British Patent 942,853. Nov. 27, 1963. Filed Nov. 1, 1961.

A process is described for protecting niobium and niobium-base alloys from oxidation at high temperatures. The surface of the niobium is mechanically coated with one or more stable compounds chosen from one or more of the groups of nitrides, borides, arsenides, and oxides followed by sintering. (R.E.U.)

8744 CERAMIC MATERIALS. Allen Davidson Goode (to Doulton and Co., Ltd.). British Patent 942,945. Nov. 27, 1963. Filed Jan. 19, 1960.

A neutron-absorbing body comprising a single substantially homogeneous fired ceramic mass is described. Of the total weight of the body, 4 to 8% is gadolinium oxide, samarium oxide, and didymium oxide dispersed throughout in a finely divided form. An example is given of a rod so prepared as to have a neutron capture cross section of 6×10^{24} barns. (R.E.U.)

8745 IMPROVEMENTS IN OR RELATING TO PROCESSES FOR MANUFACTURING NEUTRON-ABSORBENT MATERIALS, AND THE MATERIALS PRODUCED THEREBY. (to Societe Le Carbone-Lorraine). British Patent 946,568. Jan. 15, 1964. Priority date June 5, 1959, France.

A method for the manufacture of neutron-absorbent materials composed of substantially pure graphite and boron is described. The method consists of impregnating substantially pure and porous graphite with an alkali metal borate which is melted or in a concentrated solution. The impregnated graphite is stove without exudation of the impregnant and is dehydrated by baking in the absence of air in a carbon powder. (M.C.G.)

8746 ZIRCONIUM ALLOYS. Christopher Tyzcack and John Boulton (to United Kingdom Atomic Energy Authority). German Patent 1,155,254. Oct. 3, 1963. Priority date Oct. 21, 1958, Great Britain.

A zirconium alloy is described that is highly corrosion resistant to water vapor and pressurized water at temperatures of 325°C. The alloy consists of 0.08 to 0.35% copper, 0.65 to 2.59% tin, and the rest is zirconium containing the usual contaminations. (Gmelin Inst.)

Corrosion

Refer also to abstract 8476.

8747 (BMI-X-10071) DEVELOPMENT OF NIOBIUM-BASE ALLOYS FOR USE IN A NUCLEAR SUPERHEATER. Quarterly Progress Report for October–December 1963. Robert D. Koester, John A. DeMastry, Warren E. Berry, Arthur A. Bauer, and Frank A. Rough (Battelle Memorial Inst., Columbus, Ohio). Jan. 1, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract W-7405-eng-92. 17p. (EURAEC-938)

Niobium-base alloys resistant to 540 to 700°C steam are evaluated. Chromium, titanium, and vanadium in combinations are found to improve the corrosion resistance, while iron, molybdenum, and zirconium additions are detrimental. Cold work improves the corrosion resistance. Exposure of alloys containing chromium, titanium, and vanadium continued through 266 and 161 days for similar alloys. Alloys containing 18 to 24 at. % titanium, 12 to 18 at. % vanadium, and 9 to 12 at. % chromium show rather outstanding corrosion resistance to 540°C steam. A niobium–21 at. % titanium–12 at. % vanadium–9 at. % chromium alloy exhibits a weight gain of only 290 mg per dm^2 after 266 days of exposure. This alloy, as well as a number of other promising alloys, is characterized by a shiny black adherent oxide corrosion film of a type usually associated with good corrosion resistance. After 28 days at 650°C one 24 at. % titanium–12 at. % vanadium–12 at. % chromium alloy shows a weight gain of 386 mg per dm^2 and has a shiny black oxide coating. (auth)

8748 (CEND-198) CORRELATIONS BETWEEN SENSITIZATION AND STRESS CORROSION CRACKING OF 300 SERIES STAINLESS STEELS. Quarterly Progress Report for Period Ending, September 30, 1963. G. Zuromsky and W. Chernock (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Nov. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-3256. 11p. (EURAEC-902)

Differences in transgranular stress-corrosion susceptibility exist for stabilized and unstabilized austenitic stainless steels. It is postulated that these differences are induced by dislocation pile-up adjacent to oxidized grain boundaries. Thus, differences in transgranular crack susceptibility between sensitized and unsensitized steels are postulated when stresses are induced during test; no differences should be found in pre-stressed samples. Types 304 and 347 stainless steels are solution heat-treated at 1200°C, followed by heat treatments at 650–925°C to promote carbide precipitation. The microstructures in these samples are being evaluated to determine the morphology of carbide precipitation. Methods of inducing stresses during testing are being evaluated. Use of internally pressurized tubes to permit triaxial stresses is given consideration. (auth)

8749 (DRI-2134) AN INVESTIGATION OF THE EFFECT OF METALLIC ADDITIONS UPON THE OXIDATION RESISTANCE OF TITANIUM-MODIFIED $NbAl_3$. Final Report, September 1, 1962–August 31, 1963. Walter Wheatfall and Donald T. Klodt (Denver. Univ. Denver Research Inst.). Sept. 30, 1963. Contract AT(11-1)-1092. 64p.

The air-oxidation resistance of a $(Nb-Ti)Al_3$ compound with alloy additions of tin, silicon, or chromium and silicon in combination was investigated. Thermogravimetric determinations of the specific weight gain as a function of exposure time in dry flowing air were made. Arc-melted alloy specimens were oxidized for periods of from 8 to 24 hr at temperatures of 760, 860, 960, 1060, 1160, 1260, and 1360°C (1400, 1580, 1760, 1940, 2120, 2300, and 2480°F). The base compound contained niobium and titanium in the atomic ratio of 3:1, respectively. Alloy additions of 1.0, 3.0, 5.0, 7.0, 10.0, 15.0, and 20.0 wt % increments were made to the base material along two composition direction lines in the case of silicon and tin additions, and along one composition direction line for the chromium–silicon combination additions. A second $(Nb-Ti)Al_3$ material with niobium to titanium in the ratio of 3:2 was also studied. Tin additions of 1.0, 3.0, 5.0, and 7.0 wt % along one composition direction line were made to this base and thermogravimetric runs at 960 and 1160°C (1760 and 2120°F) were conducted. The oxidation data obtained are reported in terms of engineering values of specific weight changes as function of time and temperature and, also, an evaluation of the oxidation kinetics is presented. A survey study of the phase equilibria of the as-cast and isothermally annealed alloys was conducted and the results are presented. A basic oxidation study of $NbAl_3$, $(Nb-Ti)Al_3$, and an $(Nb-Ti)Al_3$–1.0% Sn alloy was

made and the oxidation rate laws determined. The kinetic data from these studies are presented. (auth)

8750 (GEAP-4453) STATISTICAL TECHNIQUES USED IN THE SPECIFIC ZIRCONIUM ALLOY DESIGN PROGRAM. J. L. Jaech (General Electric Co. Vallecitos Atomic Lab., San Jose, Calif.). Nov. 11, 1963. Work Performed Under United States–Euratom Joint Research and Development Program. 29p. (EURAEC-947)

A statistically designed empirical approach is being used to choose a candidate Zr alloy optimum with respect to corrosion and hydriding rates in steam and having acceptable mechanical properties. The statistical techniques used and the reasons for their use are discussed in detail, with emphasis on the estimation of corrosion rates. Estimation of response surfaces is also considered. (D.L.C.)

8751 (GNEC-295) CHLORIDE DEPOSITION FROM STEAM ONTO SUPERHEATER FUEL CLAD MATERIALS. F. Bevilacqua and G. M. Brown (General Nuclear Engineering Corp., Dunedin, Fla.). Oct. 18, 1963. Contract AT (40-1)-2674. 156p.

Experiments using Cl^{38} in a steam test loop were conducted to study the deposition behavior of chlorides on BONUS superheater fuel assembly materials. The moisture content of the steam was varied between 0 and 0.5 wt %, and superheat was added up to 15°F before the steam passed over the test cartridge heater. The effects of variables on the chloride deposition on the heater were studied in detail. Chloride deposition from moist steam was found to result in heavy, adherent deposits which are conducive to severe chloride stress corrosion of austenitic steels, while removal of all moisture from the incoming steam reduces the chloride deposition and minimizes the chloride stress corrosion. The heater surface condition was found to be a very important variable; deposition is increased by surface defects and pits. Neither the temperature of steam or heater nor the amount of superheat had an appreciable effect on the deposition, when no moisture existed in the steam. However, low steam velocities and spacer protuberances increase the deposition. Different clad materials (Inconel and Type 304 and 347 stainless steel) with similar surface conditions did not affect the deposition, although subsequent corrosion effects do modify the deposition behavior. Recommendations are given for the control of chloride deposition in nuclear superheater reactor systems. (D.L.C.)

8752 (HW-78388(p.9.1-4)) MATERIALS DEVELOPMENT, CORROSION, AND HEAT TRANSFER STUDIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Zircaloy-2 samples exposed to 540°F water in the ETR G-7 loop (7.6×10^{13} nv fast) corroded roughly 15 times the rate of comparison coupons exposed out-of-reactor. Oxidation rates for thoria dispersion-hardened nickel were determined. Oxidation of crystal bar zirconium and Zircaloy-2 in 600°C CO was ten times lower than in steam at the same temperature. Comparisons of the corrosion of various nickel and iron alloys in deoxygenated 3000 psi, 550°C steam with data from oxygenated systems indicated little effect from 3 to 4 ppm O_2. In tests of aluminum alloys in 330°C deionized water, corrosion rates increased 50 to 100% as the ΔT in the loop increased from 8 to 55°C. Radiation effects on aluminum alloy corrosion were determined in the H-1 loop. Oxidation and deuterium absorption of Zircaloy-2 and Zircaloy-4 in D_2O at pD10 LiOD were determined. Studies were continued on the mechanism by which zirconium is charged with hydrogen in excess of solubility. The ninth pressure tube to be discharged from the PRTR for destructive testing was examined. (M.C.G.)

8753 (KAPL-M-SFB-1) CORROSION OF K-SEALS IN 600°F AMMONIATED WATER. Stanley F. Bubar (Knolls Atomic Power Lab., Schenectady, N. Y.). Sept. 10, 1963. Contract W-31-109-eng-52. 19p.

K-Seals were examined for use as a seal in certain mechanical, high pressure connections, such as thermocouples. The results of the test show that the gold plated K-seal makes a good leaktight seal in 600°F, ammoniated water. The use of nickel or copper strikes is shown to result in flaking of the gold due to corrosion of the strike metal. Electroless nickel plate is shown to have inadequate resistance to this environment. The applied torque required to effect a leak tight seal was investigated and determined to be 50 inch-pounds, for the described test conditions. (auth)

8754 (MSAR-63-168) EFFECT OF HIGH-TEMPERATURE SODIUM ON AUSTENITIC AND FERRITIC STEELS. PHYSICAL PROPERTIES OF MATERIALS. Special Summary Report. (MSA Research Corp., Callery, Penna.). Dec. 6, 1963. Contract AT(11-1)-765. 94p.

A research program is being conducted on the effects of air, helium, and sodium on the creep, creep-to-rupture, and fatigue properties of Type 316 stainless steel and $2\frac{1}{4}$ Cr–1 Mo steel. The program is divided into eight tests according to contaminants (O, C, N) in the sodium; Tests 1 and 2 have been completed, and Tests 3 and 4 are in progress. A summary of the status of the program and the results to date is presented. (D.L.C.)

8755 (MSAR-63-174) EFFECT OF HIGH TEMPERATURE SODIUM ON AUSTENITIC AND FERRITIC STEELS. PHYSICAL PROPERTIES OF MATERIALS. Progress Report No. 39, November 1963. (MSA Research Corp., Callery, Penna.). Dec. 20, 1963. Contract AT(11-1)-765. 45p.

The effects of air, helium, and sodium on the creep-rupture and fatigue properties of Armco Iron, types 304 and 316 stainless steel, and chromium–molybdenum carbon steel at 1100 and 1200°F are evaluated. The effects of carbon and oxygen contaminants in the systems are investigated. (N.W.R.)

8756 (SC-DC-64-203) MECHANISM FOR OXIDATION OF URANIUM IN CONTINUOUSLY FLOWING MOIST GASES (thesis). Ellis Daniel Verink, Jr. (Ohio State Univ. Research Foundation, Columbus). 1963. For Sandia Corp., Albuquerque, N. Mex. Contract AT(29-1)-789. 55p.

The kinetics of the oxidation of uranium in dry and moist oxygen and nitrogen were determined at 75°C. A step-wise mechanism involving uranium hydride formation as the rate-controlling step is proposed. Principal conclusions are: (1) Dry oxygen and dry nitrogen are without appreciable action on uranium at 75°C. (2) Moisture is principally responsible for the oxidation of uranium under these test conditions. (3) Oxygen inhibits attack by moisture while hydrogen accelerates attack. (4) Oxidation of uranium occurs in at least two stages obeying different time dependencies: $\Delta W_1 = k_1 t^{\frac{1}{2}}$ initial stage $\Delta W_2 = 0.378$ t second (linear) stage, where $k_1 < 0.378$ $\mu g/cm^2/min$. (5) Uranium hydride is formed in the initial, rate-controlling step and is a transitory phase. (6) The final oxidation product is a combination of stoichiometric and non-stoichiometric forms of UO_2. (7) The activation energy for the linear oxidation is low, being approximately 10 kcal/mole. (auth)

8757 (SC-DC-64-204) OXIDATION OF URANIUM IN MOIST GASES (thesis). Tatsuo Kondo (Ohio State Univ.

Research Foundation, Columbus). 1963. For Sandia Corp., Albuquerque, N. Mex. Contract AT(29-1)-789. 87p.

The kinetic study of low temperature oxidation of uranium in moist environment was conducted by means of system pressure measurement and gas chromatographic analysis of environmental gases. A mechanism including intermediate hydride phase formation at the metal-oxide interface was proposed. Principal conclusions are: 1) Moisture is principally responsible for the oxidation of uranium under these test conditions. 2) The reaction rate is principally dependent linearly on time; however logarithmic dependency and subsequent exponential time dependency, $V = k\,t^{1.5}$, are observed in the very early stage of oxidation. 3) Oxygen stifles the reaction by preventing the formation of reaction product hydrogen, hence stifles the formation of intermediate hydride phase. 4) Hydrogen accelerates the reaction by the counter effect to that of oxygen. 5) The formation of hydride is confirmed by the measurement of hydrogen yield of the gaseous system as well as the x-ray diffraction study. 6) The reaction rate is linearly dependent on initial water vapor pressure. 7) Activation energy of the reaction determined as a spread value between 5 to 12 kcal/moles. 8) The approximate amount of hydride is determined. 9) The possibilities of the mechanisms involving a combined effect of formation and destruction of protective layer are suggested. (auth)

8758 A STUDY OF THE THERMAL OXIDATION OF TANTALUM AND NIOBIUM BY MEANS OF ELECTRON-DIFFRACTION AND CAPACITY MEASUREMENTS. J. Harvey and P. H. G. Draper (Imperial Coll. of Science and Tech., London). J. Inst. Metals, 92: 136-40(Jan. 1964).

The thermal oxidation of tantalum and niobium was studied in the range 300–600°C. The rate is initially in good agreement with the Mott-Cabrera high-field law before breakaway (a sudden catastrophic increase in the oxidation rate) takes place. Electron-diffraction examinations showed that this is associated with the cessation of amorphous oxide growth and the onset of crystallization. The period of coherent oxide formation shortens with increasing temperature. Capacity measurements were used to give an estimate of the oxide thickness and the discrepancy shown between these and the gravimetric measurements of others is probably due to oxygen dissolving in the metal. In addition, the capacity begins to exhibit a marked increase with time during measurement soon after breakaway, and it is suggested that this is evidence of cracking. (auth)

8759 STUDY OF THE OXIDATION OF NON-ALLOYED ZIRCONIUM AND OF OXYGEN DIFFUSION IN THE OXIDE FILM AND IN THE METAL. J. Debuigne and P. Lehr (CNRS, Vitrysur-Seine, France). Mem. Sci. Rev. Met., 60: 911-23(Dec. 1963). (In French)

The oxidation processes of zirconium at 600-850°C were studied. A micrographic and radiocrystallographic analysis of the oxide layers formed at the surface of the metal was carried out. The kinetic results, weight gains as function of time, were completed by the study of oxygen diffusion through the oxide layer formed and in the underlying metal. (auth)

8760 COMPATIBILITY PROBLEMS IN FAST REACTORS. D. M. Donaldson (United Kingdom Atomic Energy Authority, Dounreay, Caithness, Scotland). Progr. Nucl. Energy, Ser. IV, 5: 89-121(1963).

Following an outline of the factors associated with the choice of fuels and canning materials for fast reactor systems, the compatibility of these components and of constructional materials with liquid sodium or sodium–potassium alloys are reviewed. In particular, the effects of impurities in liquid metal–solid metal systems on the corrosion and mechanical properties of these reactor materials are discussed, and attention is drawn to the extremely low levels of certain impurities that may be required during reactor operation. (auth)

8761 CORROSION AND MATERIALS OF CONSTRUCTION IN CHEMICAL PROCESSING OF REACTOR FUELS. W. B. Seefeldt (Argonne National Lab., Ill.). Progr. Nucl. Energy, Ser. IV, 5: 409-46(1963).

Fuel processing information from existing plants and from those in pilot-plant scale, including fluoride volatility processes, pyrometallurgical processes, and those for homogeneous reactor fuels, is reviewed. The history and present status of solvent extraction processes are discussed. The problems and properties of construction materials toward corrosion are considered. Alloys included in the discussion are stainless steels, Carpenter 20, Hastelloy F, Ni–O–Nel, Incoloy 804, Hastelloy X, Haynes 25, Monel, Inconel, Hastelloy B, Inor-1 and -8, Duranickel, and Nicloy 9. 79 references. (R.E.U.)

8762 ON THE EFFECT OF COMPOSITION OF ZIRCALOY ON ITS CORROSION RESISTANCE IN HIGH TEMPERATURE WATER. Goro Ito and Ryukichi Hashiguchi (Waseda Univ., Japan). Trans. Natl. Res. Inst. Metals (Tokyo), 5: 115-19(Aug. 1963).

Studies were conducted concerning the corrosion resistance of Zircaloy in high-temperature water using domestic-made sponge of zirconium as a raw material. The composition of the sponge made in Japan is shown in a table. The contents of nitrogen and carbon, which affect corrosion resistance of the alloy, are less than that of foreign-made. Results of corrosion tests conducted in high-purity water at 320°C indicated that Zircaloy having a composition of 0.8 ~ 1.2% Sn, 0.15 ~ 0.20% Fe, 0.10 ~ 0.15% Cr and <0.05% Ni showed better corrosion resistance than that of Zircaloy-2. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8763 INVESTIGATION OF THE NIOBIUM–OXYGEN SYSTEM. III. ON THE KINETICS OF OXYGEN ABSORPTION BY NIOBIUM. Erich Gebhardt and Rolf Rothenbacher (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 54: 689-92(Dec. 1963). (In German)

The reaction rate of oxygen with niobium was investigated at 5×10^{-4}, 1×10^{-3}, and 2×10^{-3} Torr oxygen in the temperature range from 1060 to 1650°C. The specimens were exposed to the gas in small isothermal-isobaric steps, homogenized, and, subsequently, quenched. The increase in oxygen content of the specimens after each step was measured by observing the change in electrical resistivity. The investigations showed that, in the range of solubility, the rate of reaction of oxygen in niobium is linear with time. The reaction rate was proportional to the gas pressure. The activation energy of this process was found to be 9.2 or 5.8 kcal/mol, depending on the application of Arrhenius' or Eyrings's relation, respectively. The adsorption of oxygen at the specimen surface appeared to be the rate controlling process. After an initially linear time dependence of the reaction rate, a retardation was observed at lower temperatures and higher pressures. This was due to saturation with oxygen of the outer specimen layer. (auth)

Fabrication

8764 (BRB-79) QUARTERLY PROGRESS SUMMARY [ON METALLURGY], JULY–SEPTEMBER 1963. (Bridge-

port Brass Co., Seymour, Conn.). Dec. 27, 1963. Contract AT(30-1)-1405. 41p.

Uranium Fabrication—Mark V-B. A clean up study and the factors affecting the machining clean up revealed that the economy of the extrusion of Mark V-B tubing could be improved significantly by reducing the amount of overstock on the extrusions. Although experimental conditions revealed further improvement is possible, an immediate reduction of the finished stock from the present 0.125" to 0.075" could be accomplished without any substantial increase in the rejection rate. Uranium Forming Development. Examination of current extrusion tooling revealed poor control over the incoming metallurgical structures of tool steels as well as the utilization of tool steels above their capabilities. NPR Billet Development. An experiment to increase the amount of working on the ID for the primary extrusion of NPR-NOE ingots revealed no improvement from the variable investigated. Basic Scoping Investigations. A temperature sensing instrument has been found that will meet the requirements established for process control on the die head end of the extrusion press. This instrument, the Infra-Red Eye, is a two-color pyrometer which eliminates the emissivity from the temperature reading. Laboratory Investigations. A limited physical property study of low additive uranium indicates the possibility of lowering the temperature of the oil bath utilized for preheating extruded tubes prior to straightening. NPR Production. A study conducted in conjunction with the production effort on NPR extrusion revealed the superiority of the chamfered ingots over the square end ingots in the resulting extrusion concentricity and straightness. (auth)

8765 (CEND-181) BURNABLE POISON ADDITIONS TO UO_2. Summary Report, July 1, 1962—June 30, 1963. G. Zuromsky, R. C. Brayer, and W. P. Chernock (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Nov. 1963. Work Performed under United States—Euratom Joint Research and Development Program. Contract AT (30-1)-3107. 52p. (EURAEC-905)

UO_2 fuel elements containing 0.05 wt % B_4C additions were vibratory compacted up to 89 percent of theoretical density by the electromechanical and pneumatic methods. Axial boron distribution was maintained within ±20 percent of the nominal value by use of special powder blending and loading techniques. Post compaction analyses indicated good correlation between the variation in boron contents, quantities of fines of UO_2-B_4C and local densities of the compacted fuel. The potential for axial migration of boron was investigated by means of thermal gradient tests utilizing short fuel rods containing an axially positioned tungsten heater to produce fuel center temperatures up to 2550°C and clad temperatures from 800 to 1150°C. Under these extreme conditions, only a slight indication of lower boron concentrations in higher temperature regions of the fuel was observed. Significant axial migration of boron had not occurred. The boron distribution in the tested rods was not significantly different from that of the as-compacted rods and was within the desired range of ± 20 wt % of the average value. (auth)

8766 (HW-SA-3132) COSTS OF FABRICATING UO_2-PuO_2 SWAGE-COMPACTED FUEL ELEMENTS. C. H. Bloomster and R. D. Widrig (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 8, 1963. Contract AT(45-1)-1350. 22p. (CONF-187-33)

From American Nuclear Society Meeting, New York, Nov. 1963.

A detailed analysis is presented of the costs of fabricating UO_2-PuO_2 fuel elements for the Plutonium Recycle Program by the cold swage compaction process. The cost breakdown includes the Zircaloy components, loading and decontamination, plant capital costs, indirect costs, and nuclear materials. (D.L.C.)

8767 (HW-SA-3258) RESISTANCE BONDING OF GRAPHITE AND REFRACTORY METALS. L. E. Mills, L. O. Slind, and E. M. Woodruff (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1, 1963. Contract AT(45-1)-1350. 20p. (CONF-375-2)

From 6th National Symposium, Society for Aerospace Material Process Engineers, Seattle, Nov. 1963.

A procedure was developed for joining graphite parts without the addition of an interface material. The process is similar to the magnetic force resistance butt welding process that has been demonstrated as an effective process for welding difficult-to-weld materials. Successful welds have been achieved by the process in refractory, reactive, ferrous, and non-ferrous metals and in materials with a ceramic dispersed phase in a metal matrix. (auth)

8768 (HW-SA-3264) FABRICATION OF CERMETS BY HIGH-ENERGY-RATE IMPACTION. D. W. Brite and K. R. Sump (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 5, 1963. Contract AT(45-1)-1350. 13p. (CONF-375-1)

From 6th National Symposium, Society for Aerospace Material Process Engineers, Seattle, Nov. 1963.

The high-energy-rate impaction of cermet materials (UO_2, UN, and other ceramic materials in a variety of metals) was investigated using a Dynapak machine. The operation of the machine is described. The microstructures of UO_2-W and other cermets are shown. The hooding of the machine for impaction of Pu-containing materials is described. Finally, the advantages of high-energy-rate impaction for fabricating cermets are outlined. (D.L.C.)

8769 (LADC-5763) THE FABRICATION OF REFRACTORY METAL SHAPES BY HIGH ENERGY RATE EXTRUSION. D. J. Sandstrom and G. S. Hanks (Los Alamos Scientific Lab., N. Mex.). [nd]. Contract W-7405-eng-36. 15p. (CONF-373-1)

From Technical Conference on Applied Aspects of Refractory Metals, Los Angeles, Dec. 1963.

The experience gathered on the extrusion of refractory metal alloys and composites into various shapes using a Dynapak machine is described. The materials extruded include W, W—Re, Mo, Nb—Zr, and Ta. The tooling used is discussed; the use of WC insert type dies increases the die life and improves the extrusion surface. Sprayed glass lubricants provides effective lubrication. Instrumentation for studies of the extrusion process is considered. (D.L.C.)

8770 (NAA-SR-Memo-8528) TERMINAL REPORT ON THE DEVELOPMENT OF TECHNIQUES FOR FABRICATING HIGH-TEMPERATURE FUEL AND CLADDING MATERIAL FOR APPLICATION IN ADVANCED NUCLEAR REACTOR CONCEPTS. N. H. Katz and E. L. Reed (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Aug. 15, 1963. Contract AT-11-1-GEN-8. 39p.

Three techniques were evaluated: (1) bonding of Be and Y tube and end plug closures, (2) vacuum induction and casting of UN fuel shapes, and (3) arc casting of UC—ZrC fuel shapes. The following conclusions are made: (1) Vacuum diffusion bonding of beryllium tubes to beryllium

end closures was found to be the best means of producing a sound, integral bond without introducing brittle phases and excessive grain growth. The technique developed may be readily scaled-up to production levels. Joining yttrium to yttrium may be effected satisfactorily by heliarc welding, after preparing the surface as described. (2) Vacuum induction melting and casting in a Y_2O_3 coated graphite crucible does not appear to be a feasible method of producing solid shapes of uranium mononitride. This conclusion is based on very limited data and should be verified by additional experimentation. (3) An arc melting and casting procedure was developed which is capable of producing fuel slugs ½ in. diameter by 6 in. long of the binary carbides UC + 1 to 10 wt % ZrC. However, the procedure in its present state as indicated by excessive carbon contamination and scatter in the results has not reached that level of development wherein control of all the variables is possible. (D.L.C.)

8771 (NMI-2123(p.1-40)) FABRICATION OF TUNGSTEN AND TUNGSTEN–RHENIUM TUBING. A. L. Geary, J. G. Hunt, S. Isserow, R. G. Jenkins, and J. L. Klein (Nuclear Metals, Inc., West Concord, Mass.).

W–25 wt % Re sleeves were extruded and evaluated. Development of techniques for drawing W tubing was continued. In the tests, which included bend tests and ring compression tests, it was found that W sleeves in different size ranges do not differ in properties and that the W–25 wt % Re sleeves met specifications. (D.L.C.)

8772 (NUMEC-P-104) DEVELOPMENT OF PLUTONIUM-BEARING FUEL MATERIALS. Progress Report, January 1 through March 31, 1963. (Nuclear Materials and Equipment Corp., Apollo, Penna.). Contract AT(30-1)-2389. 50p.

Three batches of PuO_2 were prepared via the plutonium peroxide route. Except for the high tap density, it was found that the powder characteristics of PuO_2 prepared in this manner are similar to the characteristics of PuO_2 prepared by the oxalate route. Modifications were made to equipment for preparation of mixed oxides to achieve better reproducibility and minimize operator time. A study was initiated to assess the feasibility of using gamma spectrometry for rapid in-process determination of plutonium in solutions that also contain uranium. It was found that plutonium can be determined to within 1% provided that the uranium concentration is known to better than 2 mg/ml. Plutonium separation studies using TTA extraction were continued and the determination of cesium and strontium fission products by flame photometry was investigated. The effect of carbon content on the weight loss of PuO_2 during sintering was determined. Metallographic examination of sintered UO_2–35 wt % PuO_2 pellets indicated that the low densities obtained may be due to grain growth and broadening of grain boundaries. Green spheres of PuO_2 were formed in a small mill jar and the particle size distributions of both the formable and non-formable powder fractions were determined by centrifugal sedimentation size analysis. Preparation of duplex pellets for determining the reaction between PuO_2–UO_2 and possible cladding and diluent metals was continued. Pellets of pure PuO_2 and six compositions of coprecipitated PuO_2–UO_2 were fabricated for corrosion testing in water and steam. Preliminary tests in steam at 750°F and 2200 psi for 10 hr showed no visual evidence of corrosion. The NUSURP code was modified to allow calculation of undermoderated systems. Equipment is being installed in alpha boxes. (M.C.G.)

8773 (TID-19987) ZIRCONIUM—SUMMARY REPORT ON DEVELOPMENT OF TUBES WITH INTERNAL SPIRALLED RIBS. R. B. Simonson (Harvey Aluminum, Torrance, Calif.). Nov. 8, 1960. Contract AT(07-2)-1. 33p.

A program was undertaken to develop extrusion techniques for the production of thin-walled Zircaloy-2 tubing, with internal spiralled ribs. A survey was made of previous work in this area. Several tool designs were fabricated and a series of extrusion tests was run with both aluminum billets and copper-clad Zircaloy-2 billets. Spiral ribbed tubes were produced in both materials; extrusion results, however, were generally unsatisfactory. A tube configuration was generated which approximated a round-cornered square; further, the pitch of the ribs varied from front to rear of the extruded length. (auth)

8774 (WAPD-BT-29(p.45-57)) THE DETECTION OF ALPHA-ACTIVE CONTAMINATION AND HETEROGENEITY IN UO_2 AND UO_2–SOLID SOLUTIONS BY AUTORADIOGRAPHY. J. C. Clayton and C. J. Rettger (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Alpha track autoradiography was used to evaluate chemical solution and mechanical milling procedures for preparing enriched UO_2 and some UO_2-solid solutions. No U^{235} segregation was detected in UO_2, UO_2–ZrO_2, UO_2–ZrO_2–CaO, or UO_2–ThO_2 preparations enriched by a chemical solution technique. Isotopic heterogeneity was found when any of these oxides was enriched in U^{235} by comminution. Both alpha-active surface contamination and incomplete solid solution formation were observed in sintered, depleted UO_2–PuO_2 pellet prepared by coprecipitation. (auth)

8775 (Y-DA-470) TOOLING DEVELOPMENT FOR VERY HIGH-PRESSURE PRESSING. R. P. Levey, Jr. and R. L. Huddleston (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.). Sept. 6, 1963. Contract W-7405-eng-26. 36p.

Tooling has been designed for industrial-type operations over a pressure range to 70,000 atmospheres. This tooling is hydraulically actuated by a submersion in a pressure field up to 2000 atmospheres. The efficiency of these designs is limited, primarily, by the strength of known or available materials. Present efforts have been directed toward improving this efficiency. (auth)

8776 (EURAEC-433) DETERMINATION BY CALCUTION OF THE ESSENTIAL PARAMETERS OF WELDING CYCLES. Special Report No. 7, April 1 to June 30, 1962. (Société Anonyme des Forges et Ateliers du Creusot, Paris). Work Performed under United States–Euratom Joint Research and Development Program. Contract 073-61-12 RDF. 29p. (A translation)

The laws of heat conduction to the thermal cycles of welding are evaluated. Calculations are made for determining cooling rates of thin and thick plates. The cooling rate of the plate compared to that where the welding bead is deposited is also calculated. Determinations are made for temperature distributions in the welds and plates with respect to radiation, convection, and time. Examples of practical application are given in order to show the validity of the equations. (N.W.R.)

8777 (EURAEC-749) THE SINTERING-EXTRUSION OF URANIUM–GRAPHITE POWDERS (FOR THE FORMATION OF MONOCARBIDE UC). REPORT ON COMPLETION OF STUDIES (APPENDIX: RESULTS OBTAINED OUTSIDE CONTRACT). Special Report No. 1, December 1, 1961–December 30, 1962. M. Lamotte, D. Whitwham, and J. Herenguel (Trefileries et Laminoirs du Havre. Centre de Recherches, Antony, France). Work Performed under

United States–Euratom Joint Research and Development Program. Contract 4000/r. 29p. (A translation)

The production of uranium monocarbide rods by sintering-extrusion of uranium and graphite powders is described. The sintering of U–C mixtures up to 4.8% of graphite is possible for all the particulate size distributions studied, on condition that extrusion is carried out at 750 to 820°C and that extrusion ratios from 8 to 20 are employed. Information is included on: the risk of spontaneous reaction being produced in the die, heating conditions after extrusion necessary for the total conversion of the graphite into monocarbide, porosity, surface roughness, veritable cracks, density, particle size, and conditions of diffusion reaction. (N.W.R.)

8778 (EURAEC-786) DEVELOPMENT OF PROCESSES FOR THE PREPARATION OF URANIUM CARBIDES AND CERMETS ON A U–C BASE. Quarterly Report No. 12, April 1 to June 30, 1963. P. Himmelstein, F. Hofmann, B. Liebmann, and L. Schaefer (Nuklear-Chemie und-Metallurgie G.m.b.H., Wolfgang bei Hanau am Main, Germany). Work Performed under United States–Euratom Joint Research and Development Program. Contract 088-62-7 RDD. 9p. (A translation)

The UC reaction furnace with semi-continuous operation was interrupted due to a breakdown in the current supply installation. After the defect was remedied and a new charging device was built in, the furnace was operational. Uranium carbide rods were cast in the centrifugal casting furnace. Numerical data concerning the melting conditions are included. The copper crucible of the tipping furnace was provided with a new edge with a special cooling device. By means of this crucible it was possible to pour UC without damaging the edge. (auth)

8779 (EURAEC-820) STUDY OF RESIDUAL STRESSES CAUSED BY THE UPWARD VERTICAL WELDING PROGRESS. Quarterly Report No. 7, July 1–September 30, 1963. (ARCOS, S. A., Brussels). Work Performed under United States–Euratom Joint Research and Development Program. Contract 053-61-12-RDB. 53p. (A translation)

The 60-mm-thick sample welded at the end of 1962 was studied. Results of the determination of the surface stresses and the penetration measurements are given. The determination of stresses in depth and the survey of the exact position of the temperature measurement couples are in progress. The 100-mm-thick sample was welded, and the control of the heat balance and a survey of the displacements during the welding and the deformations after welding are given. A method for measuring the biaxial stresses in depth, which could be utilized in addition to the method previously developed, is described. (auth)

8780 (EURAEC-826) DEVELOPMENT OF PROCESSES FOR THE PREPARATION OF URANIUM CARBIDES AND CERMETS ON A UC BASE. Quarterly Report No. 13, July 1 to September 30, 1963. P. Himmelstein, F. Hofmann, B. Liebmann, and L. Schaefer (Nuklear-Chemie und-Metallurgie G.m.b.H., Wolfgang bei Hanau am Main, Germany). Work Performed under United States–Euratom Joint Research and Development Program. Contract 088-62-7 RDD. 12p. (A translation)

UC with carbon contents between 4 and 5 wt % was prepared in the UC reaction furnace for semi-continuous operation. In the tilting furnace, fusions were carried out under reduced pressure (down to 30 torr) preparatory to vacuum-melting tests. The uranium carbides produced were examined for their carbon content. This carbon content could be adjusted in a reproducible way. Measurements of granulometry revealed that the rods melted in the tilting furance had a finer grain than those prepared in the centrifugal furnace. Ground rods were found to be very sensitive to corrosion. Corrosion tests are under way. (auth)

8781 (EURAEC-881) STUDY OF ELEMENTARY CRACKING. PRELIMINARY QUALIFYING STUDY OF WELDING PROCEDURE. Quarterly Report No. 3, June 1–September 30, 1963. (Institut de Soudure, Paris). Work Performed under United States–Euratom Joint Research and Development Program. Contract 090-62-12 RDF. 17p. (A translation)

The study of elementary cracking of welded steel plates was continued by Pellini tests. The production of weld beads is evaluated along with the theory of weld cracking. (N.W.R.)

8782 (EURAEC-891) FIRST FABRICATION OF U–Pu ELEMENTS FOR SUBSTITUTION EXPERIMENTS IN AQUILON AND OSCILLATIONS IN MINERVE AND MARIUS (NATURAL U/Pu ALLOYS WITH 6% of Pu^{240}). Special Report No. 15. C. Mercier and J. Pajot (France. Commissariat à l'Énergie Atomique, Paris and France. Commissariat à l'Énergie Atomique. Centre d'Études Nucléaires, Cadarache). Aug. 1963. Work Performed under United States–Euratom Joint Research and Development Program. 84p. (A translation)

A description is given of the fabrication of the fuel elements required for the first substitution experiment in the Aquilon reactor as well as for oscillation tests in the Minerve and Marius reactors, the purpose of these experiments being the determination of integral quantities and the properties of dual uranium-plutonium lattices. The substitution set consists of 24 elements containing 8 slugs each: the fuel rod made from a U–Pu alloy with 0.043% in weight of plutonium (6% of Pu^{240} and 94% of Pu^{239}) is clad in aluminium. The oscillation set comprises 4 lots of 5 slugs each: fuel rod made from a U–Pu alloy with 0.025%, 0.043%, 0.075%, and 0.10% respectively for each lot, in weight of plutonium of the same isotopic composition as above. Every important phase in fabrication and control is analyzed. Numerical data are brought together and shown in tabulated form. It has been possible to dilute 310 g of plutonium in 720 kg of uranium in a homogeneous manner, as demonstrated by the results of the analyses and counts. The desired concentrations have been obtained with a fair approximation. The method used for sealing the cans by means of araldite-cemented plugs proved to be perfectly adapted to the problem and very easy in its application. (auth)

8783 (JPRS-22597) SOME FEATURES OF WELDING NIOBIUM AND ITS ALLOYS. D. S. Balkovets and L. N. Kaganov. Translated from Svarochn. Proizv., No. 10, 10-12(Oct. 1963). 10p. (OTS-64-21205)

A considerable gas content in niobium alloys (≥0.01% O_2 and ≥0.02% H_2) substantially lowers the plasticity of joints made by argon arc welding. Vacuum annealing before welding and especially after welding increases the plasticity of the welded joints. In the case of spot and roller welding of niobium alloys, the greatest difficulty lies in the melting of the copper electrodes on account of the high melting points of these alloys. The use of screens and graphite coating of the welded parts substantially reduces the melting of the electrodes. (auth)

8784 RISE IN TEMPERATURE DURING SWAGING OF URANIUM DIOXIDE. Yutaka Honda and Shuichiro Takahashi (Mitsubishi Atomic Power Industries, Inc., Omiya, Japan). Nippon Kinzoku Gakkaishi, 27: 367-65(Aug. 1963). (In Japanese)

As a part of studies on a swaging process for fabrication of UO_2 fuel rods, energetics in swaging was dealt with mainly by investigation of temperature rise during the process. The temperature was measured by a thermocouple of Chromel-Alumel or Pt–PtRh inserted into UO_2 powder in a stainless steel tube. Optical and electron microscope observations and specific heat measurements were also carried out. The conclusions are summarized as follows: (1) Preliminary heating of the sample results in a great deal of temperature rise; the rise is as high as 1680°C for hot swaging at 720°C, whereas it is about 170°C for cold swaging. (2) Plastic deformation of UO_2 and friction between UO_2 particles are main causes for the heat generation. The former is dominant in hot swaging, and the latter in cold swaging. (3) Excellent compactability of UO_2 powder in the swaging process is due to atomic diffusion activated both by the temperature rise and the stress during swaging. (4) In hot swaging, most of the working energy is consumed by plastic deformation of UO_2, leading to a pronounced temperature rise. A minor part of the energy is stored in UO_2 as internal energy connected with lattice distortion and lattice defects. (5) In cold swaging, friction between particles, fracture of particles, and lattice distortion play important roles in consuming the working energy. Since a considerable part of the lattice distortion during cold swaging is elastic, the working energy for the elastic distortion of the lattice is consumed by impact between the die backer and roll. (6) Specific heat measurements show that some of the internal energy stored in cold swaged compacts is released at the temperature range between 450°C and 900°C. The internal energy resulting from cold swaging is also demonstrated by the fact that bonding among particles in cold swaged compacts becomes better after room temperature aging for several months. (auth)

8785 PREPARATION OF BERYLLIUM THIN FILMS. G. P. Walters and W. C. Fuller (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. AIME, 227: 1462-3(Dec. 1963). (AERE-R-4319)

A method for the preparation of Be thin films is presented. The bulk specimens are mechanically or chemically thinned to ~0.005 in. and then electropolished in a system containing orthophosphoric acid, CrO_3, distilled H_2O and glycerol. After electropolishing, the foils are thoroughly washed in hot distilled water. Washing is followed by cutting microscope specimens off the edges of the foil in absolute alcohol. Finally the specimens are ultrasonically cleaned in absolute alcohol. (P.C.H.)

8786 MELTING AND CASTING OF URANIUM AND ITS ALLOYS. Andrzej Hofman (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). 16p. (CONF-207-8). (In Polish)

From Second Yugoslavian Polish Symposium on Uranium Technology and Metallurgy, Zakopane, Poland, Sept. 1963.

Apparatus for melting and casting uranium is described. The construction of the induction furnace, the vacuum system, and the crucible used are discussed. Also presented are the physical and technical parameters of melting and casting uranium and its alloys. The possibility of uranium refinery is also discussed. (TTT)

Properties and Structure

Refer also to abstracts 9317 and 9713.

8787 (BNL-7510) A NEUTRON DIFFRACTION INVESTIGATION OF THE MAGNETIC STRUCTURE OF $TbMn_2$. Lester M. Corliss and Julius M. Hastings (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 10p. (CONF-342-6)

From Conference on Magnetism and Materials, Atlantic City, Nov. 1963.

$TbMn_2$ crystallizes with the cubic Laves-phase structure (C15-type) which may be regarded as the spinel structure without the anions. The "A" sites are occupied by Tb ions and the "B" sites by Mn ions. Neutron diffraction powder patterns run at 4.2°K exhibit a number of extra reflections characteristic of a modulated magnetic structure. These additional reflections can be indexed on the basis of a spiral modulation propagated along [110] with a wavelength of 50.3 Å. The spiral axis is along [001]. The "B" sites are ordered in a manner which is entirely analogous to the low-temperature ordering of Fe_3O_4; the two sublattice spirals being 180° out of phase. The A sublattice is in phase with a particular one of the two B sublattices. The combination of the internally compensated B sites and the ferromagnetically coupled A sites leads to a ferrimagnetic spiral. (auth)

8788 (BNL-7623) POINT DEFECTS IN METALS. G. J. Dienes (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract AT-30-2-GEN-16. 122p.

A series of six lectures is presented which outlines the basic knowledge of point defects in metals and describes current research work. The lectures are entitled as follows: general theory, physical properties and point defects, concentration of point defects in metallic crystals, annealing theory, annealing experiments, and diffusion with external generation of defects. A bibliography of 136 references is included. (D.L.C.)

8789 (CONF-356-7) THE ELECTRON THEORY OF SIMPLE METALS AND ALLOYS. Morrel H. Cohen (Chicago. Univ. Inst. for the Study of Metals). [1963]. Contract AT(11-1)-636. 42p.

From 1963 American Society of Metals/Metals and Materials Show, Cleveland, Oct. 1963, 23rd National Convention of the Society for Nondestructive Testing.

The successes and difficulties of the Bloch model of a metal are briefly reviewed, and the Landau quasi-particle theory and the pseudopotential theory are briefly discussed. These two notions are made the basis for a revised version of the Bloch model that avoids the conceptual difficulties of the original model, while retaining and explaining its appealing features. Well known empirical generalizations concerning the relative importance of conduction-electron density, composition, and structure for the electronic properties are presented, and their implications are reexamined. A theory of the form required by the empirical generalizations is developed. Recent approximate calculations are discussed, and a variety of conclusions are drawn from these relating to the possibility of explanation of the empirical generalizations by the theory. 42 references. (auth)

8790 (DMIC-188) THE ENGINEERING PROPERTIES OF COLUMBIUM AND COLUMBIUM ALLOYS. F. F. Schmidt and H. R. Ogden (Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio). Sept. 6, 1963. Contract AF33(616)-7747. 237p. (AD-426255)

Results are presented of a state-of-the-art survey covering Nb and 18 of its most promising alloys. All data are given in tabular and graphical form covering some of the more important physical, mechanical, and metallurgical properties for each material. References are given at the conclusion of each material section. (auth)

8791 (DPST-63-74-10) HYDRIDE ORIENTATIONS AND MECHANICAL PROPERTIES OF THIN-WALLED ZIRCALOY TUBING. USAEC-AECL Cooperative Program Monthly Progress Report, October 1963. R. P. Marshall (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Dec. 1963. Contract AT(07-2)-1. 9p.

Tests at applied stresses of 26,000 psi showed that longitudinal specimens of the six types of tubing were not susceptible to stress orientation of the hydride platelets. Study of grain structure and hydride morphology in circumferential specimens indicated that the magnitude of the stress orientation susceptibility may have been influenced by the Zircaloy grain size. The tendency of the platelets to form into "clusters" (heterogeneous nucleation) was increased by higher stress levels and slower cooling rates in some types of tubing but not in others. (auth)

8792 (DRI-2131) DETERMINATION OF THE NIOBIUM-RICH REGION OF THE TERNARY PHASE DIAGRAMS, NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM. Quarterly Report No. 5. Albert S. Yamamoto (Denver. Univ. Denver Research Inst.). Dec. 1963. Contract AT(11-1)-1092. 11p.

Three tentative isotherms in the niobium-rich region of the niobium–tungsten–hafnium alloy system at 1600, 1300, and 1100°C are presented. Only two phase-fields are present in these partial isotherms. The single-phase field is the niobium terminal solid solution, and the two-phase field consists of the niobium solid solution and a second phase whose identity is not yet known. An x-ray study of selected alloys will be made to identify the second phase. Also included are the microhardness contour diagrams for these alloys. Homogenization treatment of 39 niobium–tungsten–zirconium alloys is complete. (auth)

8793 (EURAEC-827) THE DEVELOPMENT OF A NEW DETERMINATION OF THE DUCTILE-BRITTLE TRANSITION TEMPERATURE. Quarterly Report No. M 63-1209-26150, July 1, 1963–September 30, 1963. H. C. van Elst (Netherlands. Nijverheidsorganisatie, TNO, The Hague). Oct. 1, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 068-61-11-RDN. 44p.

Framing camera recordings of the propagation of running brittle fractures in reactor vessel steels (Soudotenax 56, HSB55C, 1.2 MD 07, and T_1) are evaluated using the Robertson thermal gradient test. The stepwise propagation of the brittle fracture shows an increase in steplength and halting time with increasing temperature. Information is given on Charpy V-test values, test temperatures, average fracture velocities, brittle strength, thickness, and test complications. The development of methods to generate stress waves by the discharge of a condenser with high capacity and voltage is continuing. The magnetic interaction of the discharge current and its induced current in a metal piece at the end of a non-conductive pressure bar could be used for the generation of stress waves of 10 kg/mm^2. An underwater spark from the condenser discharge yielded a stress wave of 10 kg/mm^2 in a pressure bar. A barium titanate pressure gage is being developed for recording the stress-time performance of these waves. The shock waves emitted by a running brittle fracture have peak pressures of 120 kg/mm^2 and time-widths of 4 to 5 μsec. The quality of the reactor vessel steels is confirmed in the stress wave attenuation experiments and transition temperatures corresponding with the Robertson temperature are deduced. (N.W.R.)

8794 (GAMD-4441) THE INFLUENCE OF COATED PARTICLES ON THE PHYSICAL PROPERTIES OF GRAPHITE-MATRIX FUEL COMPACTS. W. V. Goeddel and J. M. Pontelandolfo (General Atomic Div., General Dynamics Corp., San Diego, Calif.). July 23, 1963. Contract AT(04-3)-167. 14p.

The effects of coated particle concentrations up to 40 vol % on the physical properties of both hot-pressed and extruded matrix graphite were determined. The strength of extruded graphite-matrix fuel bodies was found to be essentially unaffected by the addition of as much as 40 vol % coated particles, in sharp contrast to hot-pressed bodies which showed a pronounced decline in strength at fuel loadings greater than 30 vol %. However, the hot-pressed compacts were considerably stronger than the extruded bodies at low fuel concentrations. The addition of coated particles caused a substantial decrease in the initial high thermal conductivities of both hot-pressed and extruded fuel compacts, particularly in the lower range of fuel temperatures. Thermal conductivities (measured at 1200°C) were above 15 Btu/hr °F ft for fuel loadings of up to 40 vol % in hot-pressed compacts and 20 vol % in extruded compacts. It is concluded that coated particle concentrations of up to 30 vol % can be accommodated in graphite-matrix fuel compacts fabricated by hot-pressing or extrusion with no serious dimunition in physical properties. (auth)

8795 (HW-72031) HIGH-TEMPERATURE, SHORT-TIME, URANIUM CARBIDE–METAL REACTIONS. J. A. Christensen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1963. Contract AT(45-1)-1350. 23p.

The relative compatibility of UC with nine metals was investigated. Samples of UC were heated in contact with W, Ta, Mo, Zircaloy-2, AISI 304L SS, Inconel, Hastelloy F, Nb–1% Zr, and Nb–33% Ta–1% Zr, for 10 min periods at 1000 to 2400°C. W and Mo were the least reactive metals tested. The UC–stainless steel reaction was the most rapid at all temperatures. Zr, Nb, and Ni-base alloys reacted least of the common cladding materials. Decarburization of hyperstoichiometric UC (UC_{1+x}) resulted in excessive carbide formation in Nb and probably in some of the other alloys. (P.C.H.)

8796 (NMI-2123(p.41-6)) FUNDAMENTALS OF SINGLE-CRYSTAL DEFORMATION IN ZONE-REFINED BERYLLIUM. D. F. Kaufman and L. R. Aronin (Nuclear Metals, Inc., West Concord, Mass.).

The preparation of a zone-refined single crystal containing ~1 wt % Ni was completed. The anomalous mechanical properties of several Be specimens containing Fe are summarized. Studies of the effects of heat treatment on the mechanical properties are in progress. Compression test results are given for a specimen containing Fe and a high-purity specimen. (D.L.C.)

8797 (ORNL-3390) THE EXPERIMENTAL DETERMINATION OF THE THERMAL CONDUCTIVITY OF MOLTEN LITHIUM FROM 600 TO 1550 DEGREES FAHRENHEIT (thesis). J. W. Cooke (Oak Ridge National Lab., Tenn.). Jan. 23, 1964. Contract W-7405-eng-26. 162p.

Submitted to Univ. of Tennessee. Knoxville.

A comparative, axial-heat-flow thermal conductivity apparatus utilizing compensating guard heating was developed to determine the conductivity of molten lithium from 600 to 1550°F. By this method, heat flowed downward through a heat meter, through a cavity containing the lithium sample, through another heat meter, and into a water-cooled sink. Heat flow in the radial direction was minimized by maintaining with guard heaters an axial temperature profile in a coaxial guard tube which matched the axial temperature profile along the centerline of the apparatus. The lithium conductivity was determined from the known conductivity of the heat meters and from the axial temperature gradients and cross-sectional areas of the heat meters and lithium sample. The temperature gradients were determined using Pt/90Pt + 10Rh thermocouples, and type 347 stainless steel was used for the heat meters. Initial filling difficulties caused by the high-surface tension, large heat of fusion, and low density of the lithium were overcome, and the cavity was successfully filled with a void-free sample of 99.8+ wt % lithium metal. Careful assembly and operation of the apparatus insured against extraneous thermal and electrical emf's sample contamination, radial heat flow, thermocouple drift, and nonsteady state. Twenty-six determinations were made of the conductivity of the molten lithium sample. From 600 to 1550°F, the results can be represented to within ±2.2% rms deviation by the least squares equation: $k\ (Btu/hr \cdot ft \cdot °F) = 19.76\ [1 + 5.01 \times 10^{-4}\ t\ (°F)]$. From consideration of many possible sources of error, the total uncertainty in the results was conservatively estimated to be less than ±8 to ±15% from the lower to the higher temperatures. That the actual uncertainty was probably less than the total uncertainty is evidenced by (a) the good agreement between the two independent axial-heat-flow measurements [the difference varying from 0.1 to 3.8%], (b) the modest amount of radial heat exchange [always ≤0.9% of the axial-heat flow], and (c) the consistency of the axial temperature profiles. Extrapolations to the melting point of the present data, previous results, and values predicted by the Wiedemann-Franz relationship agree to within ±7%; whereas above 1000°F, the present results compare well only with predicted values, particularly in temperature dependency. The temperature dependency of the present results is positive, which is contrary to the data of either molten sodium or potassium, but is consistent with the volumetric coefficient of thermal expansion of molten lithium being almost half that of either molten sodium or potassium. From a broad extrapolation of the present data to the calculated critical conductivity, the conductivity of the molten lithium appears to reach a maximum of 45 Btu/hr · ft · °F at 3200°F. This will require further investigation at high temperatures for verification. By substituting a niobium alloy for the stainless steel, the present apparatus could be used to extend the conductivity data to the normal boiling point (2403°F). (auth)

8798 (ORNL-3526) SELF-DIFFUSION OF BERYLLIUM IN UNIRRADIATED, COLD-PRESSED AND SINTERED BERYLLIUM OXIDE. H. J. de Bruin and G. M. Watson (Oak Ridge National Lab., Tenn.). Jan. 29, 1964. Contract W-7405-eng-26. 39p.

Diffusion of beryllium-7 through polycrystalline unirradiated specimens of BeO was studied as a preliminary step to a study of diffusion in irradiated material. Beryllium-7 was deposited on one end of cylindrical specimens by exchange and adsorption from aqueous solution. The depth of penetration perpendicular to the surfaces of deposition was determined after annealing the specimens at pre-determined conditions. A simple lapping device of high precision was developed to determine penetration depths. For the polycrystalline cold-pressed and sintered BeO studied, the diffusion behavior between 1150 and 1800°C is described by the empirical relation: $D = 2.49 \times 10^{-3} \exp -(62.5 \times 10^3/RT)\ cm^2/sec$. A diffusion model is proposed based on vacancy migration which suggests identical activation energies for diffusion in both a and c directions in single crystals and predicts an activation energy of the correct order of magnitude. Furthermore, the model predicts that the frequency factor in the direction perpendicular to the c axis should be about 50% higher than that parallel to the c axis. (auth)

8799 (TID-19990) A STUDY OF HIGH-TEMPERATURE PROPERTIES OF TITANIUM AND ZIRCONIUM PHOSPHIDES AND RELATED REFRACTORY MATERIALS. Progress Report, January 1, 1963 to November 30, 1963. Karl A. Gingerich (Pennsylvania State Univ., University Park). Dec. 1963. Contract AT(30-1)-2541. 105p.

Eight articles on the vaporization of transition metal phosphides are included; separate abstracts were prepared for 3. Five articles previously abstracted in NSA include information on vaporization of UP, vaporization behavior of nonstoichiometry of PrP, PrAs, PrSb, and PrBi, stability and vaporization behavior of Group IV–VI transition metal monophosphides, vaporization and phosphorus decomposition pressures of WP, and mass spectrometric study of the vaporization of UP. (P.C.H.)

For abstracts of individual sections see: 8800, 8332, and 8333.

8800 (TID-19990(Paper 3)) VAPORIZATION OF TRANSITION METAL PHOSPHIDES. K. A. Gingerich (Pennsylvania State Univ., University Park). 3p.

Studies were made on the vaporization of the monophosphides of Mo, W, Nb, Ta, Ti, Zr, Hf, Pr, and U, as well as trithorium tetraphosphide and the thorium subphosphide. All of the phosphides but UP vaporized by decomposition into gaseous phosphorus and a condensed phase with lower phosphorus content. UP vaporized primarily by decomposition into gaseous U and P. From an investigation of the phosphorus dissociation pressures as a function of composition of the condensed phase, it was found that Th subphosphide and PrP exhibit at the temperature of investigation broad ranges of homogeneity ($ThP_{0.8}-0.7$ and $PrP_{1.0-0.9}$) while $\beta-ZrP$ and TiP appear to have small ranges of homogeneity. Data on partial molal enthalpies of P_2 dissociation at 2000°K are given. (P.C.H.)

8801 (UCRL-11073) DIFFUSION OF IRON INTO SINGLE-CRYSTAL MgO (thesis). Stuart L. Blank (California. Univ., Berkeley. Lawrence Radiation Lab.). Nov. 15, 1963. Contract W-7405-eng-48. 30p.

MgO single crystals were packed in iron powder and heated in a vacuum at 1150, 1250, and 1350°C. Concentration-vs-penetration profiles were determined by using the electron microprobe analyzer. The interdiffusion coefficient D is found to be concentration dependent in the range 1 to 22 at. % Fe. At 1150°C $D = 8.1 \times 10^{-12} e^{0.150[Fe]}\ cm^2/sec$; at 1250°C $D = 1.60 \times 10^{-11} e^{0.173[Fe]}$; and at 1350°C $D = 2.40 \times 10^{-11} e^{0.190[Fe]}$. The apparent activation energy for diffusion increases with the iron concentration. At an iron concentration C = 5 at. %, $D = 6.34 \times 10^{-7} \exp(-29{,}600/RT)$; at C = 10 $D = 4.49 \times 10^{-6} \exp(-32{,}900/RT)$; at C = 15 $D = 5.04 \times 10^{-5} \exp(-37{,}700/RT)$; and at C = 20 $D = 8.40 \times 10^{-4} \exp(-43{,}500/RT)$. (auth)

8802 (WADD-TR-61-72(Vol.XXII)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS.

VOLUME XXII. PHOTOMICROGRAPHIC TECHNIQUES FOR CARBON AND GRAPHITE. G. L. Peters and H. D. Shade (National Carbon Co. Advanced Materials Lab., Lawrenceburg, Tenn.). Apr. 1963. Contract AF33(616)-6915. 42p.

Photomicrographic techniques have been used to examine the microstructure of the many grades of formed carbon and graphite developed under Contract No. AF33(616)-6915. These techniques have aided in the study of these grades and in predicting or understanding their behavior in various applications. Photomicrography has allowed identification of various materials such as cokes, graphites, pitch, etc., within the formed article and has permitted a study of the distribution of these materials. The effect of impregnation of the graphite with pitches and resins can be more clearly defined by careful photomicrographic examination. Standard metallographic equipment can be used for such studies but preparation of the carbon and graphite requires special techniques. Mounting methods to prevent smearing or chipping of the samples during preparation and to obtain very highly polished surfaces are discussed. Also described are various techniques of lighting to aid in revealing and interpreting microstructure, and the different types of photographic film, plates, developers, and printing papers required for showing pertinent details in the final photomicrograph. (auth)

8803 (WADD-TR-61-72(Vol.XXIV)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XXIV. THE THERMAL EXPANSION OF GRAPHITE IN THE C_0-DIRECTION. C. E. Lowell (National Carbon Co. Research Lab., Parma, Ohio). June 1963. Contract AF33(616)-6915. 17p.

The thermal expansions of lampblack base, coke base, hot worked coke base, and pyrolytic graphites were measured in the c_0 direction from 1000 to 2700°K by use of a high temperature x-ray camera. The results indicate that, (a) the coefficient of thermal expansion is not constant with temperature and (b) this coefficient increases with increasing crystallite perfection. The camera was modified to accept a low temperature attachment and the a_0's and c_0's of lampblack base, hot worked coke base, and pyrolytic graphite were evaluated at 6, 78, and 298°K. The three graphites showed similar expansion characteristics and, within the limits of error, seemed to show a negative a_0 expansion coefficient near 298°K. (auth)

8804 (WADD-TR-61-72(Vol.XLI)) RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XLI. SURVEY AND ANALYTICAL REPRESENTATION OF THE SPECIFIC HEAT OF GRAPHITE. G. B. Spence (National Carbon Co. Research Lab., Parma, Ohio). June 1963. Contract AF33(616)-6915. 50p.

A literature survey was made of the experimental values of the specific heat of graphite. Most of the measurements from 20 to 3800°K were reanalyzed and a new average curve is given for each experimental run. Some of the new curves are significantly different from the original curves. Estimates are given of the $C_p - C_v$ term, the electronic specific heat, and the specific heat of the lattice vibrations. The lattice specific heat was approximated by various combinations of Einstein and one- and two-dimensional Debye functions. The characteristic temperatures were selected by a least-squares curve-fitting procedure. (auth)

8805 (AI-Trans-64-1) CONCEPT OF VIRTUAL BOUND LEVELS. J. Friedel. Translated by Anthony Cornell (Atomics International., Div. of North American Aviation, Inc., Canoga Park, Calif.), from J. Phys. Radium, 23: 692-700(Oct. 1962). Jan. 1964.

The electronic structure of transitional impurities dissolved in normal metals is discussed in terms of d-virtual bound levels. Their physical properties at great dilutions and their possible magnetic couplings are considered. (auth)

8806 (EURAEC-59) REPORT ON THE LITERATURE STUDY FOR THE SELECTION OF A SUITABLE METHOD FOR THE DETERMINATION OF THE THERMAL CONDUCTIVITY OF CERAMIC BODIES ON THE BASIS OF URANIUM OXIDE-BERYLLIUM OXIDE. Quarterly Report No. 1. (Battelle Institut e. V., Frankfurt am Main). Mar. 30, 1961. Work Performed under United States-Euratom Joint Research and Development Program. 33p. (A translation).

A survey is given of the various methods for determining thermal conductivity in ceramic bodies. The methods are evaluated with respect to divergences and advantages. The theory of the various methods are discussed with respect to the various measuring conditions. The development and use of testing equipment are evaluated. The bibliography contains 54 references. (N.W.R.)

8807 (EURAEC-431) STUDY OF THE EMBRITTLEMENT OF MANGANESE-MOLYBDENUM WELDING STEELS ARISING DURING STRESS-RELIEF ANNEALING FOLLOWING WELDING. Special Report No. 5. (Société des Forges et Ateliers du Creusot, Paris). [nd]. Work Performed under United States-Euratom Joint Research and Development Program. Contract 013-61-12 RDF. 42p. (A translation)

The effects of pressure-relief annealing treatments after welding operations on the ductility of Mn-Mo steel were studied in detail for three welding steel grades. The results show that the Mn-Mo steels are subject to irreversible temper embrittlement (upper-nose temper embrittlement), but not to reversible temper embrittlement. An aging-after-tempering phenomenon was also produced in samples subjected to tempering after annealing. The addition of Mo was found to cause irreversible temper embrittlement at lower temperatures and shorter times. The law of this embrittlement was found to be similar to that of the softening of a steel during tempering. Recommendations are given for minimizing this embrittlement during relief annealing. (D.L.C.)

8808 (EURAEC-807) THERMAL BEHAVIOR OF URANIUM OXIDE FUEL UNITS DENSIFIED BY VARIOUS TECHNIQUES. Special Report S14. H. Andriessen and J. M. Leblanc (Centre d'Étude l'Énergie Nucléaire, Brussels and Société Belge pour l'Industrie Nucléaire, Brussels). [1962]. Work Performed under United States-Euratom Joint Research and Development Program. Contract 078-61-12 RDB. 46p. (A translation of BN-6306-02).

In order to limit the cost of the complete fuel cycle in nuclear reactors, it is of the utmost necessity to find a fuel with as high a cooling rate as possible. However, the thermal power which can be extracted from a fuel unit is limited on the one hand by the thermal conductivity of this fuel unit and, on the other hand, by the maximum central temperature permitted. The object of the work undertaken is, on the one hand, to determine the variation of the thermal conductivity of uranium oxide fuel units densified by various methods (pellets and densification by vibration, swaging, etc.) in terms of the temperature and, on the other hand, to evaluate the effect of structural modifications in the material (sintering, grain growth, etc.) on the thermal conductivity. Out-of-pile thermal simulation tests on uranium oxide fuel units have shown that the thermal

conductivity of UO_2 increases from 1000 to 1400°C onwards. The formation of a basaltic structure and the preferred radial orientation of the grains have a favorable effect on heat transfer. The experiments carried out have enabled the unfavorable effect of the UO_2 pellets–cladding radial space on the effective thermal conductivity of the fuel unit to be shown, and the influence of the filling gas and the impurities on artificial fission products to be evaluated. (auth)

8809 (JPRS-22593) INVESTIGATION OF THE TERNARY SYSTEMS NIOBIUM–TUNGSTEN–ZIRCONIUM AND NIOBIUM–MOLYBDENUM–ZIRCONIUM. E. M. Savitskii (Ye. M. Savitskiy). Translated from Issled. Splavov Tsvetn. Metal., Akad. Nauk SSSR, Inst. Met., No. 4, 108-16 (1963). 12p. (OTS)-64-21201)

Polythermal sections of the ternary systems niobium–tungsten–zirconium and niobium–molybdenum–zirconium (with ratios W : Zr = 4 : 1, 1 : 1, 1 : 3 and Mo : Zr = 2.1 : 1, 1 : 1, 1 : 3) were studied by the methods of microscopic investigation, determination of the melting point, microhardness, and x-ray diffraction study. Projections of these diagrams onto the plane of the concentration triangle, as well as isothermal sections at the temperatures 2000, 1800, and 1100° were constructed. It was shown that the ternary systems niobium–tungsten–zirconium and niobium–molybdenum–zirconium possess similar structures within the investigated temperature range. It was established that the mutual solubility of W with Zr and Mo with Zr in niobium in the solid state is limited and is greatly reduced when the temperature is lowered. (auth)

8810 THE STRUCTURES OF THE INTERMETALLIC PHASES $MoAl_{12}$, $ReAl_{12}$, AND $TcAl_{12}$. L. K. Walford (Cambridge Univ., Eng.). Acta Cryst., 17: 57-9(Jan. 10, 1964).

X-ray methods were used to refine the structures of $MoAl_{12}$, $ReAl_{12}$, and $TcAl_{12}$. The unit cell is bcc and the structures are nearly the same as that of WAl_{12}. The interatomic distances of the three phases are compared and those of $MoAl_{12}$ are compared with distances in other Mo–Al phases. (auth)

8811 THE EMPIRICAL FORMULAE OF INTERMETALLIC COMPOUNDS BY NEUTRON ACTIVATION. H. Simpson (Atomic Energy Research Establishment, Wantage, Berks, Eng.). Acta Cryst., 17: 59-60(Jan. 10, 1964).

Neutron activation analysis was applied to the determination of the empirical formulas of some Tc–Al and Mo–Al compounds. An outline of the technique is given. The method is of general application and is particularly suitable when accurate results are required from limited quantities (ca 5 mg) of material. The results on Al–Mo and Al–Tc alloys were sufficiently consistent to indicate probable crystallographic formulas of $MoAl_{12}$ and $TcAl_{12}$ with milligram quantities of material. (P.C.H.)

8812 χ PHASE IN A NIOBIUM–RHENIUM ALLOY. R. Steadman and P. M. Nuttall (Bradford Inst. of Tech., Eng.). Acta Cryst., 17: 62-3(Jan. 10, 1964).

An investigation was made on the χ phase in Nb–Re alloys. It was found that in accordance with the alloy composition, the unit cell contains 14.5 atoms of Nb and 43.5 of Re. To discover the effect of varying the degree of ordering between the D_1 and D_2 sites, calculations were carried out with other arrangements. The results show that the residual steadily diminished as the Nb not accommodated in the d and c sites was increasingly concentrated in the D_1 site, until a minimum of 0.12 was reached when Nb was almost entirely absent from D_2. With this structure, the R value computed over all the observed reflexions was 0.22. Data are tabulated. (P.C.H.)

8813 THE CRYSTAL STRUCTURE OF ThPd. J. R. Thomson (Imperial Coll. of Science and Tech., London). Acta Cryst., 17: 64-5(Jan. 10, 1964).

Powder photographs of samples whose composition was close to 50 at. % Pd were indexed on the basis of an orthorhombic lattice with a = 7.249 ± 0.005, b = 4.571 ± 0.003, c = 5.856 ± 0.004A, and observed and calculated values of $\sin^2\theta$ are tabulated. Trial atomic parameters based on those of ThSi, of $x_{Th} = 0.18$, $z_{Th} = 0.125$, $x_{Pd} = 0.03$, $z_{Pd} = 0.61$ gave a fairly good fit to the observed intensities. The total coordination around the Th and Pd atoms of 17 and 9, respectively, is the same as that around the Th and X atoms in the six ThX compounds of the CrB type, although the detailed arrangements differ in the two structures. (P.C.H.)

8814 THE STRUCTURE OF $SrZn_2$. B. G. Bergman and P. J. Shlichta (California Inst. of Tech., Pasadena). Acta Cryst., 17: 65-6(Jan. 10, 1964).

An investigation of the Sr–Zn system disclosed a phase, in slowly cooled alloys of 40 to 60 wt % Zn, characterized by prismatic crystals embedded in an eutectic matrix. Both crystals and matrix had to be stored under hexane to prevent reaction with air. A chemical analysis of 50 mg of crystals, selected from an alloy containing 40 wt % Zn, indicated a composition of 55.6 wt % Zn. An alloy of 55 wt % Zn gave an x-ray powder pattern almost identical with that of the pulverized crystals; the density of the sample was 4.71 g cm^{-3}. Refined values of unit cell edges gave a = 4.779 ± 0.002, b = 7.795 ± 0.001, c = 7.820 ± 0.001 Å. Data are tabulated. (P.C.H.)

8815 THE EFFECT OF SHORT-RANGE ORDER ON STACKING FAULT ENERGY AND DISLOCATION ARRANGEMENTS IN f.c.c. SOLID SOLUTIONS. G. Thomas (Univ. of California, Berkeley). Acta Met., 11: 1369-71 (1963). (UCRL-10751)

An increase in stacking fault energy, γ, was observed in Cu-(30-34 at.%)Zn for very slowly cooled alloys and for specimens aged 1 hr at 200°C after rapid quenching, whereas in quenched alloys, γ falls continuously. The dislocations remain coplanar in the alloys that showed an increase in γ but were not extended. Similar effects were also found in certain austenitic stainless steels. When the Ni content of high-purity Fe/Cr base alloys is increased, the stacking fault energy increases. (P.C.H.)

8816 RESIDUAL STRAIN AND THE FRACTURE STRESS-GRAIN SIZE RELATIONSHIP IN BRITTLE SOLIDS. F. J. P. Clarke (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Acta Met., 12: 139-43 (Feb. 1964).

A model for the fracture stress-grain size relationship was developed for anisometric brittle solids. It is shown that if account is taken of residual lattice strain, then a form of Griffith equation can be developed that takes the basic flaw to be an intergranular pore. The role of residual strain lies in providing an effective surface energy term whose magnitude depends on the grain size. The resulting equation is applied to published data on beryllium oxide. (auth)

8817 THE ROLLING TEXTURE AND STACKING-FAULT ENERGY OF THORIUM, CERIUM AND THORIUM–CERIUM ALLOYS. I. L. Dillamore, I. R. Harris, and R. E. Smallman (Univ. of Birmingham, Eng.). Acta Met., 12: 155-8(Feb. 1964).

Texture determinations on pure thorium and a range of cerium–thorium alloys indicated that thorium has a stack-

ing fault energy higher than copper ($\gamma \simeq 70$ ergs/cm^2). It was found, also, from texture determinations, that at high deformations in rolling at room temperature, the $\gamma_{(fcc)}$ to $\beta_{(hexagonal)}$ transformation occurs in pure cerium. This indicates a stacking fault energy for cerium approaching zero. As little as 10% thorium added to the cerium is sufficient to raise its stacking fault energy to about 40 ergs/cm^2. (auth)

8818 THE EFFECT OF INTERSTITIALS ON MECHANICAL TWINNING IN BODY-CENTERED CUBIC METALS. J. O. Stiegler, C. K. H. DuBose, and C. J. McHargue (Oak Ridge National Lab., Tenn.). Acta Met., 12: 263-4(Feb. 1964).

Electron microscope observations of dislocation configurations in foils of high purity Nb and Nb doped with 500 ppm carbon, both deformed at 78°K, are described. A few mechanical twins were produced in the high purity specimen during deformation at liquid nitrogen temperature. The specimens fractured and most of the deformation, including the twins, was confined to the region near the fracture. The doped specimens failed to twin and elongated several per cent by Luders band propagations. In the doped material the dislocations existed in irregular tangles that often appeared to be associated with precipitates on grown-in dislocations. The observations suggest that not only are type and quantity of interstitial important in determining twinning behavior, but that the distribution also can significantly effect the behavior. (P.C.H.)

8819 DECORATION OF GRAPHITE SURFACES FOR ELECTRON MICROSCOPY. G. R. Hennig (Argonne National Lab., Ill.). Appl. Phys. Letters, 4: 52-5(Feb. 1, 1964).

Surface steps, dislocations, adsorbed impurities, and point defects on cleaved graphite crystals were rendered visible under electron microscopy by evaporating a Au monolayer onto the crystal surface, which was then maintained at 250°C or higher. The Au aggregates preferentially at the surface irregularities. Chemical attack by active gases increased the concentration of nuclei for gold aggregation and resulted in surface compounds, which could then be studied. Direct decoration and replication were equally successful. (D.C.W.)

8820 THE THEORY OF COALESCENCE OF GASEOUS PORES UNDER CONDITIONS OF SWELLING. L. P. Semenov. At. Energ. (USSR), 15: 404-8(Nov. 1963). (In Russian)

Under conditions of swelling, the decomposition of the supersaturated solid solution formed is accompanied by the formation and the subsequent growth of the grains of a new phase. During the latter stages, the process of the redistribution of these grains across the solution or coalescence play an important role. The kinetics of this process was examined for the case of gas-induced swelling, considering the pores saturated with an inert gas mixture as the grains of the new phase. Two specific cases were examined more closely: annealing conditions, under which the amount of gas in the system remains constant, and continual increase of the amount of gas with time. The chief characteristic of the coalescence process is the time-dependence of the average pore radius; this value was calculated, assuming that the total surface of the pores remains unchanged. The coalescence is usually accompanied by an increase of the sample volume. In the case of the continuous increase of the gas, the coalescence process involves mainly the redistribution of the pore dimensions, as a result of which, pores with dimensions smaller than a given critical value are dissolved, resulting in a decrease of the number of pores. Equations were derived for the asymptotic solution of the number of pores and their average dimensions. (TTT)

8821 CERAMICS FOR BREEDING MATERIALS, MODERATORS, REFLECTORS, CONTROL RODS, SHIELDING MATERIALS AND STRUCTURAL ELEMENTS, AS WELL AS THOSE FOR THERMO-ELECTRICAL POWER GENERATION. H. J. Oel (Max-Planck-Institut für Silikatforschung, Wurzburg, Ger.). Ber. Deut. Keram. Ges., 40: 73-84(Feb. 1963). (In German)

Economical operation of large-capacity reactors requires that they should be operated at very high temperatures. Because of these high temperatures there is a wide range of applications for ceramic products in this field. A survey is given of the requirements for suitable materials, which are classified into groups, and relevant problems are discussed. (auth)

8822 THE PROPERTIES OF MASSIVE BODIES OF ZIRCONIUM HYDRIDE AND THOSE PRODUCED BY THE METHODS OF POWDER METALLURGY. J. Motz (Internationale Atomreaktorbau GmbH, Bensberg, Ger.). Ber. Deut. Keram. Ges., 40: 91-101(Feb. 1963). (In German)

Methods of manufacturing massive zirconium hydride bodies are described. The following properties are tabulated (on the basis of literature and experimental results): heterogeneous equilibrium, specific heat, density, expansion, thermal conductivity, and strength. (auth)

8823 CONCRETE AS A MATERIAL FOR REACTORS. R. Vinkeloe (Forschungsinstitut für Hochofenschlacke, Rheinhausen, Ger.). Ber. Deut. Keram. Ges., 40: 103-8 (Feb. 1963). (In German)

With reference to general requirements for radiation-protection materials, concretes of various compositions when used with the most common aggregates are discussed. Data are tabulated on the possible densities with radiation-protection concretes and their permanent water contents. The manufacture of a dense and faultless homogeneous concrete is discussed on the basis of various measurements made at different concrete works. In view of the fact that a radiation-protection concrete must be free from cracks it was concluded that elasticity is the most important property for such materials. A comparison was drawn between the traditional manufacture of concrete (mixing, placing in position, compacting) and the production of poured concrete (adding coarse aggregate and then pressing with mortar). (auth)

8824 CERAMIC RADIATION-ABSORPTION MATERIALS CONTAINING RARE EARTHS. H. Lehmann and K. H. Mueller (Institut für Steine und Erden der Bergakademie Claustal-Zellerfeld, Ger.). Ber. Deut. Keram. Ges., 40: 109-12(Feb. 1963). (In German)

Radiation absorbers containing rare-earth oxides such as gadolinium, europium, samarium, and dysprosium may be used in future high-temperature reactors. The conditions for producing ceramic materials in the system $BaO-Ln_2O_3-SiO_2$ (where Ln_2O_3 is a rare earth oxide), reactions during firing, and technological properties were studied. A material consisting of 20 mol.% BaO, 50 mol.% Gd_2O_3, and 50 mol.% SiO_2 and fired at 1500°C was found to suit best the requirements for a radiation-absorbing material in high-temperature reactors. Further investigations concerned materials containing monazite sand. (auth)

8825 CERAMIC STRUCTURAL MATERIALS FOR THE ABSORPTION OF GAMMA RAYS AND NEUTRONS.

H. Schumann (Universität, Marburg, Ger.). Ber. Deut. Keram. Ges., 40: 113-17(Feb. 1963). (In German)

From the oxides of lead and zirconium ceramic bodies can be produced which, when fired at about 1000°C, will have a specific gravity of up to 5.0. Their capacity to absorb gamma radiation is half that of metallic lead. By sintering lead oxide with minerals of rare earths it is possible to produce materials with specific gravities of up to 5.9 and a neutron-trapping cross section in the order of magnitude of 10^3. Some materials containing boron oxide have similar properties. (auth)

8826 THE SIGNIFICANCE OF OXIDES AND CARBIDES FOR FUEL ELEMENTS OF NUCLEAR REACTORS. H. Bumm (Kernreaktor Bau- und Betriebs-GmbH, Karlsruhe, Ger.). Ber. Deut. Keram. Ges., 40: 118-22(Feb. 1963). (In German)

Reasons that have led to the changeover from metallic uranium to the use of oxides and carbides as fuels are described. The difficulties arising with different methods of producing fuel elements from oxide ceramics and the techniques in the production of fuel elements are discussed. The advantages of the vibration compaction process in which a powdered material of a certain composition and grading can be filled in a fuel-element can and compacted to a very high density by electro-mechanical vibrations is considered. The actual sintering of this compacted powder material takes place only in the reactor itself in which it is promoted by an intensive neutron radiation at comparatively low temperatures. The dispersion materials and the methods of their production are reviewed. These combination materials are distinguished by a particularly high resistance to both radiation damage and mechanical loads. (auth)

8827 THE CONTACT POTENTIAL DIFFERENCE BETWEEN TUNGSTEN AND NIOBIUM. B. J. Hopkins and K. J. Ross (Univ. of Southampton, Eng.). Brit. J. Appl. Phys., 15: 89-92(Jan. 1964).

Contact potential difference measurements were made between tungsten and niobium foil using both the Kelvin and the displacement of the retarding potential line techniques in ultra-high vacuum conditions. Values of 0.18 ± 0.04 and 0.17 ± 0.03 v were obtained, respectively, leading to a mean work function for niobium of 4.37 ± 0.03 ev. (auth)

8828 STUDIES OF FATIGUE OF Ni_3Al-Ni_3Nb ALLOYS. M. P. Arbuzov and V. G. Chuprina (Kiev Inst. of Aeronautics). Izv. Vysshikh Uchebn. Zavedenii, Fiz., No. 5, 82-5(1963). (In Russian)

X-ray analysis of solubility maxima for Ni_3Nb and Ni_3Al indicated 43 wt % for Ni_3Nb at 1280°C and 46 wt % Ni_3Nb at 1300°C. The melting points of the alloys were found between 1305 and 1300°C with eutectic points between 1300 and 1295°C. Electric resistance of the specimens was 440×10^{-5} ohm, following annealing at 1295°C the resistance increased to 457×10^{-5} ohm. Further heating to 750°C reduces the resistance. The hardness of 35 wt % Ni_3Nb was 450 Vickers units, and following annealing at 1295°C, 385. Tempering for 4 hours at 750°C increased the hardness to 500 units. (R.V.J.)

8829 A SUBMICRON SECTIONING TECHNIQUE FOR ANALYZING DIFFUSION SPECIMENS OF TANTALUM AND NIOBIUM. R. E. Pawel and T. S. Lundy (Oak Ridge National Lab., Tenn.). J. Appl. Phys., 35: 435-8(Feb. 1964). (ORNL-TM-575)

A microsectioning technique for tantalum and niobium was successfully used to remove uniform sections of metal less than 100 Å in thickness from the surface. The technique, based on the formation and subsequent stripping of an anodic oxide film, is presently used to study diffusion phenomena in these metals. The apparent sensitivity is sufficient for low-temperature diffusivity measurements in reasonable times. It may also be possible to describe more quantitatively previously reported anomalous diffusion behavior near the metal surface. The details of the experimental technique are considered, and typical diffusivity data for the diffusion of Nb^{95} in tantalum are presented. (auth)

8830 GROWTH OF WHISKERS DUE TO SOLID-TO-SOLID PHASE TRANSFORMATION IN ZIRCONIUM. M. M. Nieto (Cornell Univ., Ithaca, N. Y.) and A. M. Russell. J. Appl. Phys., 35: 461-2(Feb. 1964).

An investigation was made of the growth of whiskers from 0.15 mm zirconium wire due to the h-c-p to b-c-c phase transformation at 863°C. (C.E.S.)

8831 WORK FUNCTION IN THE SYSTEM THORIUM–RHENIUM. Elias P. Gyftopoulos (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys., 35: 464(Feb. 1964).

It is shown that the experimental results on the work function of a rhenium surface partially or fully covered by thorium determined by Anderson et al. (NSA 17: 37735) are in agreement with the results of Gyftopoulos and Levine (NSA 16: 9231). (C.E.S.)

8832 HEATS OF MIXING IN BINARY LIQUID–ALKALI-METAL MIXTURES. T. Yokokawa and O. J. Kleppa (Univ. of Chicago). J. Chem. Phys., 40: 46-54 (Jan. 1, 1964).

The enthalpies of mixing in all the binary-liquid alloys formed among the alkali metals sodium, potassium, rubidium, and cesium were measured by reaction calorimetry at 111 ± 2°C. All systems except rubidium–cesium show positive enthalpies of mixing. There is a tendency for the mixing enthalpies to become more positive and also more unsymmetrical as the two metals become more separated in the periodic table. A comparison of the new enthalpy data with reported phase-diagram information indicates that the three liquid alloys that contain sodium all exhibit nearly ideal entropies of mixing. For potassium–rubidium, potassium–cesium, and rubidium–cesium, the new heat data, combined with the available phase diagrams, permit estimates to be made of the excess free energies of mixing in the solid solutions. (auth)

8833 ALLOYS OF THORIUM WITH CERTAIN TRANSITION METALS. I. THE SYSTEMS THORIUM–RUTHENIUM AND THORIUM–RHODIUM. J. R. Thomson (Imperial Coll. of Science and Tech., London). J. Less-Common Metals, 5: 437-42(Dec. 1963).

The thorium–ruthenium and thorium–rhodium binary systems were studied over the whole range of compositions in the temperature range 1000 to 1500°C by metallographic and x-ray methods. Four intermetallic compounds were formed between thorium and ruthenium namely, Th_7Ru_3, Th_3Ru_2, ThRu, and $ThRu_2$, while in the thorium–rhodium system the compounds Th_7Rh_3, ThRh, Th_3Rh_4, Th_3Rh_5, $ThRh_2$, $ThRh_3$, and $ThRh_5$ were detected. $ThRh_2$ undergoes a polymorphic transformation above 1200°C. (auth)

8834 THE URANIUM–RHENIUM ALLOY SYSTEM. R. J. Jackson, D. E. Williams, and W. L. Larsen (Ames Lab., Ames, Iowa). J. Less-Common Metals, 5: 443-61 (Dec. 1963).

The phase diagram of the uranium–rhenium alloy system is presented along with a discussion on trans-

formation kinetics of the uranium solid solutions. The phase diagram is of the double eutectic type with the intermediate phase having the composition URe_2. This phase exhibits allotropy at 180°C and melts congruently at 2200°C. URe_2 reacts sluggishly with the uranium solid solutions below 750°C to form the peritectoid compound U_2Re. Eutectic reactions occur at 1105 and 2105°C at respective compositions of 10.5 and 65.5 wt% Re. Eutectoid reactions occur at 643 and 681°C at compositions of 1.4 and 6 wt% Re, respectively. The maximum solubility of rhenium in α uranium is about 0.4 wt% at 643°C and in β uranium is 1.9 wt% at 681°C. The solubility of rhenium in γ uranium is 6 wt% at 681°C and increases to about 7 wt% at 975°C. The solubility of uranium in rhenium is 0.6 wt% at room temperature with little variation up to 2000°C. Alloys of β and γ uranium containing more than about 1.2 and 7 wt% Re respectively, can be readily supercooled to room temperature. Rapid cooling of γ alloys containing less than about 7 wt% Re resulted in a direct $\gamma \rightarrow \alpha'$ transformation, the α' state being a supersaturated α phase having a banded microstructure. Evidence is presented for the existence of two transition states, one involving the γ phase decomposition and the other the $\beta \rightarrow \alpha$ transformation. The sequence of phase changes involved in cooling the uranium solid solutions is discussed. (auth)

8835 ON THE STRUCTURE OF THE SYSTEM URANIUM–NIOBIUM–CHROMIUM. G. Petzow and A. Junker (Max-Planck-Institut für Metallforschung, Stuttgart). J. Less-Common Metals, 5: 462-76(Dec. 1963). (In German)

The ternary system uranium–niobium–chromium was studied from the aspect of phase constitution. The alloys were examined by means of microscopy, thermal analysis, temperature-temperature difference measurements, and x-ray diffraction. The liquidus surfaces and the course of the troughs therein were determined. Isothermal sections at 1050, 850, and 550°C and four vertical sections are presented that give an idea of the shape of the phase region in terms of temperature and concentration. Five four-phase-equilibria were observed at 890, 730, 690, 635, and 615°C. Typical of this system are wide heterogeneous phase regions, which in most cases contain the intermetallic $NbCr_2$-phase. The addition of chromium does not prevent the liquation of the bcc uranium–niobium solid solution (γ) at temperatures lower than 1000°C. In the case of the β-solid solution of the binary uranium–niobium system the eutectoid decomposition temperature is shifted from 640 to around 615°C by addition of chromium whereas for the γ_1-solid solution no shift in the temperature of 650°C was observed. (auth)

8836 STACKING FAULTS IN THE REFRACTORY METALS AND ALLOYS. A REVIEW. J. S. Hirschhorn (United Aircraft Corp., North Haven, Conn.). J. Less-Common Metals, 5: 493-509(Dec. 1963).

Energetically favorable dislocation dissociation reactions that may take place in the bcc structure are discussed. The various methods of measuring the stacking fault energy are critically reviewed. Reasonably accurate values can be obtained from observation of thin films by transmission electron microscopy. Perhaps the most important obstacle to utilizing this lattice defect is an incomplete understanding of the effect of solute atoms (alloying additions and impurities) on the stacking fault energy. It is shown that at thermodynamic equilibrium the solute segregates at the fault and, thereby, reduces the fault energy and increases its width. The refractory metals have high intrinsic fault energies and solute segregation would appear to be necessary if faults are to be formed. Stacking faults have been observed in impure niobium and tungsten, and a molybdenum-35 at.% rhenium alloy. Such dislocation processes as cross slip and climb have been shown to be a function of the fault energy; that is, the activation energies for such processes increase with decreasing fault energy. In addition, the motion of complete slip dislocations may be impeded by faults; on the other hand, the Peierls-Nabarro friction stress may be lower for partial dislocations that form the boundaries of stacking faults. It was concluded that with suitable alloying and thermal treatment reasonably large faults can be formed. By studying the mechanical behavior of refractory alloys and giving consideration to the presence of stacking faults, the effect of this lattice defect on the high temperature strength and low temperature ductility of these materials may be determined. 66 references are included. (P.C.H.)

8837 NMR, MAGNETIC SUSCEPTIBILITY, AND ELECTRONIC SPECIFIC HEAT OF Nb AND Mo METALS AND Nb–Tc AND Nb–Mo ALLOYS. D. O. Van Ostenburg (Argonne National Lab., Ill.), D. J. Lam, Masao Shimizu, and Atsushi Katsuki. J. Phys. Soc. Japan, 18: 1744-54 (Dec. 1963).

Magnetic susceptibility and nuclear magnetic resonance measurements were made in Nb–Tc alloys. Calculations on the temperature variations of electronic specific heats and magnetic susceptibilities are performed for Nb and Mo metals and Nb–Mo alloys by making use of the density of states determined from low temperature specific heat data for 4d transition metals and their alloys. Temperature variations of the electronic specific heats for Nb and Mo metals are explained. Temperature variations of the magnetic susceptibilities of these metals and their alloys are explained by taking account of the effect of the temperature independent orbital paramagnetism and the effects of the negative (for Nb metal) and the positive (for $Nb_{0.75}Mo_{0.25}$ alloy) molecular fields. The Knight shifts of Nb^{93} and Tc^{99} in Nb–Tc and Nb–Mo alloys are discussed. It is shown that the main contribution to these Knight shifts appear to arise from the orbital paramagnetism of the d electrons. (auth)

8838 STUDY ON THE PROPERTIES OF LOW MANGANESE STAINLESS STEEL. Satoshi Watanabe and Masaya Ozawa (National Research Inst. for Metals, Tokyo). Kinzoku Zairyo Gijutsu Kenkyusho Kenkyu Hokoku, 6: 95-101(Apr. 1963). (In Japanese)

Low-manganese stainless steel was prepared as reactor structural material with a low neutron cross section, and the mechanical properties and corrosion properties were investigated. It was observed that general properties other than hot working properties were not affected significantly by lowering manganese content. The hot working properties became poorer when manganese content was lowered, but this was overcome by adding a small amount of zirconium. Vacuum fusion was also effective in recovering the hot working properties. With regard to corrosion properties, the stability of the passive state was increased by lowering the manganese content. The addition of zirconium had little effect on corrosion properties as long as the content was low. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8839 COMPARATIVE STUDY OF CREEP IN IMPERFECT SINGLE CRYSTALS AND POLYCRYSTALS OF α-URANIUM. J.-P. André, P. Grenier, and P. Lacombe

(Ecole Nationale Supérieure des Mines, Paris). Mem. Sci. Rev. Met., 60: 888-94(Dec. 1963). (In French)

A study of the variation of activation energy during creep with temperature on uranium polycrystals and imperfect single crystals, showed that with polycrystals the energy remains constant above 550°C with a value of 42 ± 2 kcal/mole, near the value found for self-diffusion. The observation of a polygonization occurring during creep suggests that the rate process of deformation is controlled by climb of dislocations. For imperfect single-crystals, the activation energy value is higher than the value found for polycrystals. An explanation is proposed in relation with the pre-existing polygonization due to the $\beta \rightarrow \alpha$ transformation. (auth)

8840 CURRENT PROBLEMS ON FUEL CLADDING MATERIALS FOR NUCLEAR REACTORS. [PART] II. Yoshitsugu Mishima (Tokyo Univ.). Newer Metal Ind. (Tokyo), 8: 283-9(Aug. 1963). (In Japanese)

Current problems on each fuel cladding material are considered as related to the type of reactors and especially to the kind of coolant. As cladding materials for water-cooled research and power reactors, aluminum, zirconium, and niobium alloys as well as stainless steel are compared. Special emphasis is placed on the problem of hydrogen pick-up by zirconium alloys for water-cooled power reactors. Japanese cooperated researches to be concluded in the near future are surveyed. (auth)

8841 MAGNETISM OF EuS, EuSe AND EuTe. U. Enz, J. F. Fast, S. van Houten, and J. Smit. Philips Res. Rept., 17: 451-63(Oct. 1962).

The preparation, crystal structure, and magnetic properties of EuS, EuSe, and EuTe are described. EuS and EuSe are found to be purely ferromagnetic compounds with Curie temperatures of 16 and 6°K, respectively, whereas EuTe is antiferromagnetic with an asymptotic Curie point of −7.5°K and a Néel temperature of 11°K. It is concluded that the exchange interaction between nearest-neighbor metal ions is of a direct type. The same conclusion is drawn for MnO and MnS. The magnetization for both EuS and EuSe is measured as a function of the temperature for several fieldstrengths in the region of 14.3 to 32.1 kOe. It appears that the dependence of the magnetization on temperature and fieldstrength can be described satisfactorily by the Weiss-field theory. For these measurements a special apparatus was used, which is described. (auth)

8842 X-RAY DIFFRACTION OF Th_2Al CONTAINING HYDROGEN. J. H. N. van Vucht. Philips Res. Rept., 18: 21-34(Feb. 1963).

Room-temperature x-ray diffraction of hydrogen solutions in the intermetallic compound Th_2Al shows that, in compositions lying between $Th_8Al_4H_8$ and about $Th_8Al_4H_5$, a two-phase region occurs. From $Th_8Al_4H_5$ upward the hydrogen solutions remain homogeneous up to the saturation level corresponding to $Th_8Al_4H_{15.4}$. The volume of the unit cell increases monotonically, but the a-axis of the cell increases up to the composition $Th_8Al_4H_8$ and then decreases linearly on further hydrogenation until approximately the value of the original hydrogen-free compound is reached. Apart from a general discussion of the nature of the hydrogen-metal interaction, a model of the system studied is proposed. The model implies an orderly, or a strong tendency towards an orderly, arrangement of the hydrogen atoms in the interstices of the lattice of half-saturation, in $Th_8Al_4H_8$. (auth)

8843 NEUTRON DIFFRACTION AND PROTON MAGNETIC RESONANCE OF DEUTERIUM AND HYDROGEN SOLUTIONS IN Th_2Al. J. H. N. van Vucht. Philips Res. Rept., 18: 35-52(Feb. 1963).

Room-temperature neutron-diffraction diagrams of powder samples of $Th_8Al_4D_8$, $Th_8Al_4D_{12}$, and $Th_8Al_4D_{15.4}$ indicate that a dissolved hydrogen atom occupies a crystallographically sixteenfold position. This is situated in 8 pairs of tetrahedral holes; each couple of tetrahedra has one plane in common. The four other tetrahedral holes are less likely. For the non-saturated specimens a random occupation of these holes agrees best with the experiment. At 95°K no orderly arrangement of hydrogen in $Th_8Al_4D_8$ was found. Proton-magnetic resonance measurements were made with specimens of compositions $Th_8Al_4H_8$, $Th_8Al_4H_{12}$, $Th_8Al_4H_{15.4}$, and $Th_8Al_4H_{\approx 8}D_{\approx 8}$, at room temperature and downwards as far as 77°K. At room temperature the non-saturated specimens show motional narrowing of the resonance peaks, due to rapid interstitial diffusion of the protons. The fully saturated specimens yield broad lines. The second moments of these lines and also those of the low-temperature lines of $Th_8Al_4H_8$ and $Th_8Al_4H_{12}$ are in agreement with the neutron-diffraction results. Also, no evidence of an orderly arrangement of hydrogen in $Th_8Al_4H_8$ was found. (auth)

8844 THE PROBLEM OF ORDER OR DISORDER OF HYDROGEN IN $Th_8Al_4H_8$. J. H. N. van Vucht. Philips Res. Rept., 18: 53-60(Feb. 1963).

Theoretical considerations of the behavior of hydrogen atoms in a system of paired interstitial holes in a metallic lattice led to the conclusion that the occurrence of three points of inflexion in the pressure isotherms of hydrogen gas, in equilibrium with this system, necessarily means that, calculated per hydrogen atom, an occupation of the double holes by a single hydrogen atom is energetically more favorable than a double occupation. (auth)

8845 NEW COMPOUNDS RELATED TO THE SUPERCONDUCTORS V_3Ga AND Nb_3Sn. J. H. N. Van Vucht, H. A. C. M. Bruning, and H. C. Donkersloot (Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). Phys. Letters, 7: 297(Dec. 15, 1963).

The discovery of three gallium–vanadium phases is reported. These phases are related to the isostructural compounds: Mg_2Hg_5; Nb_6Sn_5 or Ti_6Sn_5; and A_6B_7. Lattice constant measurements were made for each of the phases. (B.O.G.)

8846 THERMAL CONDUCTIVITY OF POLYCRYSTALLINE DYSPROSIUM FROM 5 TO 305°K. R. V. Colvin and Sigurds Arajs (U. S. Steel Corp., Monroeville, Penna.). Phys. Rev., 133: A1076-9(Feb. 17, 1964).

Thermal conductivity of polycrystalline dysprosium was studied between 5 and 305°K. An abrupt decrease in the thermal conductivity occurs at the ferromagnetic-antiferromagnetic transformation. The transition from the antiferromagnetic to the paramagnetic state causes a gradual increase in the thermal conductivity with increasing temperatures. The Lorentz number of dysprosium was calculated as a function of temperature. It is concluded that in addition to the electronic thermal conductivity there is considerable lattice conductivity and possibly some magnon conductivity. An apparatus for determining the thermal conductivity of solids from liquid-helium to room temperatures is briefly described. (auth)

8847 NEUTRONOGRAPHIC DETERMINATION OF THE CRYSTAL STRUCTURE PARAMETERS OF Dy_2O_3,

Tm_2O_3, AND α-Mn_2O_3. W. Hase (Zentralinstitut fur Kernphysik, Bereich Reaktortechnik und Neutronenphysik, Rossendorf, Ger.). Phys. Status Solidi, 3: K-446-9(1963). (In German)

Neutron-diffraction diagrams were obtained for Dy_2O_3, Tm_2O_3, and α-Mn_2O_3 at a wavelength of 1.197 ± 0.003 Å. Densities were measured to be 7.84, 8.50, and 4.50 g/cm^3 for Dy_2O_3, Tm_2O_3, and Mn_2O_3, respectively. Neutron scattering amplitudes were calculated. Structural parameters obtained are presented in tabular form. (M.C.G.)

8848 LATTICE PARAMETERS AND PARAMAGNETIC SUSCEPTIBILITY OF NICKEL-RICH NICKEL–NIOBIUM SOLID SOLUTIONS. S. Arajs, H. Chessin, and R. V. Colvin (U. S. Steel Corp. Research Center, Monroeville, Penna.). Phys. Status Solidi, 3: 2337-46(1963).

The lattice parameters of solid solutions of niobium in nickel were determined up to 8 at.% niobium. The plot of lattice parameter vs composition was a straight line over the range investigated. A method based on atomic volumes of the solutes and solvent, assuming a linear relationship between concentration and atomic volumes, was capable of predicting the lattice parameters of nickel–niobium solid solutions with reasonable accuracy. The paramagnetic susceptibility of nickel–niobium alloys was measured up to about 1500°K for the first time. This paramagnetism is describable by a modification of the Curie-Weiss law, by addition of another susceptibility contribution χ_a. The quantity χ_a, which generally was assumed to be independent of the temperature, was found to increase with increasing temperatures. Niobium in nickel did not follow the Volkov-Chechernikov correlation between χ_a and the valence and concentration of the solute metal in nickel. (auth)

8849 A GREEN'S FUNCTION METHOD FOR THE FREQUENCY SPECTRUM OF AN ISOTOPICALLY DISORDERED LATTICE. Shôzô Takeno (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), Suppl., No. 23, 94-123(1962).

A systematic investigation is made of the frequency spectrum of an isotopically disordered lattice on the basis of method of Green's function. From the momentum and coordinate representations of Green's function, formal expressions for the frequency spectrum are obtained. When the number of isotopes is few, an exact analytical expression for the frequency spectrum is obtained from solutions of simultaneous equations satisfied by its coordinate representation, and the results are applied to one- and two-impurity problems. When a large number of isotopes is distributed at random, it is first shown that with use of the results for the few-impurity problem the frequency spectrum can be expanded in terms of the concentration of isotopes. Next, with the aid of a diagrammatic analysis, perturbation methods are presented for simultaneous equations satisfied by the momentum representation and for those satisfied by the coordinate representation of Green's function. By these calculations, it is established that the frequency spectrum is characterized by a shift and a damping of the spectrum of the regular lattice. Approximate analytical expressions for the frequency spectrum are obtained by employing several mathematically simplified procedures, and the concept of virtual crystal is examined. Various formal results are applied to one- and three-dimensional lattices. The criterion for the appearance of an impurity band, the shape of the main continuum of the band, etc., are studied. In the latter case, it is shown that a very heavy isotope causes a hump in the curve of the frequency spectrum in the low frequency region. (auth)

8850 TIME-DEPENDENT PROPERTIES OF AN ISOTOPICALLY DISORDERED LATTICE. Shôzô Takeno (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), Suppl., No. 23, 185-206(1962).

An investigation is made of the dynamical and the statistical dynamical behaviors of a harmonic crystal lattice containing isotopes. From equations of motion for the displacement of atoms from their equilibrium positions, integral equations are derived on the one hand, and exact expressions for propagators or velocity correlation functions are obtained on the other hand, through the cosine transform of the spectra of the correlation functions. In the latter case, the results are applied to one- and two-impurity problems. It is shown that a close relation exists between the spectra and the frequency spectrum, particularly in the case of a random distribution of isotopes; the auto-correlation function is evaluated from the frequency spectrum. The short time behavior is investigated from solutions of the integral equation that are obtained by using the method of iteration, and its relation to perturbation calculations and the moment method for the construction of the frequency spectrum is elucidated. While for the study of the long-time behavior, the effect of singularities of the spectra is examined. For a few-impurity problem, particular attention is paid to two typical singularities, the end singularity at the top of the main continuum of the band and the delta-function like spectrum associated with the localized modes. For a random lattice, the long-time behavior is shown to be determined by the end singularities, the exact determination of which is the most difficult problem of perturbation calculations. Various formal results are applied to one- and three-dimensional lattices. (auth)

8851 EFFECT OF AN ISOTOPIC IMPURITY ON THE HEAT FLOW IN ONE-DIMENSIONAL COUPLED HARMONIC OSCILLATORS. Shohei Kashiwamura and Ei Teramoto (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), Suppl., No. 23, 207-22(1962).

The effect of an isotopic impurity atom on the energy transport along the one-dimensional harmonic lattice is investigated. Assuming such an initial ensemble that the half of the system is at temperature T and the other half is at temperature zero, the mean energy of each particle is calculated as the function of time. Thus it can be shown that, for the infinitely long chain, the mean energy of each particle approaches to the different stationary values in both sides of the impurity site, namely the system finally reaches a stationary state that has a gap of the energy distribution at the impurity site. The energy flow along this linear system is also calculated. (auth)

8852 RELATION BETWEEN SPECIFIC HEAT AND THE THERMAL SCATTERING FACTOR OF X-RAYS. L. P. Potapov (Inst. of Metallurgy and Metal Physics, Moscow). Soviet Phys.-Solid State (English Transl.), 5: 1408-11(Jan. 1964).

An exact relation between the thermal scattering factor of x rays and the specific heat was derived for any form of the frequency spectrum of the lattice with the aid of integral transformations, using a frequency distribution function as a link between these quantities. (auth)

8853 STRUCTURAL STABILITY IN Ni–2ThO_2 ALLOY. Chester T. Sims (General Electric Co., Schenectady, N. Y.). Trans. AIME, 227: 1455-7(Dec. 1963).

Studies were made on the stability of the thoria phase in Ni–2TiO_2. For time-temperature exposure up to 2000 hr at 2000°F, thoria particles of the size studied

(0.001 in. or larger) were found to be highly thermally stable; they do not significantly react, agglomerate, or diffuse; and no nickel grain growth occurs. It was concluded that Ni–$2ThO_2$ is very stable and assures very promising mechanical property retention for exceptionally long times at elevated temperatures. (P.C.H.)

8854 THE EFFECT OF VACUUM PRESSING ON THE PROPERTIES OF GRAPHITE ELECTRODES. M. A. Frish, A. S. Smirnova, and M. N. Dorzhieva. Tsvetn. Metal., No. 9, 54-8(Sept. 1963). (In Russian)

Graphite samples were pressed in an electrically-heated press at a temperature of 106 to 110°C at a pressure of 1000 kg/cm^2. The apparent specific gravity of the sample increased from 1.721 at a residual pressure of 746 mm Hg std to 1.761 at a residual pressure of 10 mm Hg std. Vacuum was then applied to the pressing of graphitic rods 50 mm in diameter and electrodes 75 mm in diameter. A significant increase in density and mechanical strength was observed at a vacuum of ~700 mm Hg std. The apparent specific gravity increased from 1.579 without the use of vacuum to 1.646 at a residual pressure of 40 to 80 mm Hg std during pressure. The mechanical strength in compression increased from 213 to 264 kg/cm^2 for the vacuum-pressed sample. The bending strength increased from 96 to 126 kg/cm^2, and the rupture strength increased from 49 to 67 kg/cm^2. The porosity of the graphite decreased from 28.2 to 25.5%. The vacuum-pressed sample resisted oxidation a factor of two better on being heated to 700°C for a period of 2 hours. The higher the applied vacuum, the better was the improvement in physical properties. (TTT)

8855 A STUDY ON RUPTURE PROPERTIES OF LARGE WELDED SPECIMENS OF HT 70 STEEL FOR NUCLEAR VESSELS. REPORT I. COMPARISON WITH RESULTS OF LARGE AND SMALL WELDED SPECIMENS. Haruyoshi Suzuki (Yawata Iron and Steel Co., Ltd., Japan) and Michio Inagaki. Yosetsu Gakkaishi, 32: 805-11(Sept. 1963). (In Japanese)

Creep rupture properties at 400, 450, and 500°C of Mn–Cr–Mo–B alloy HT 70 quenched and tempered steel were investigated. Test steel 30 mm thick was produced experimentally for nuclear pressure vessels and welded joints were made with covered electrodes. The creep rupture elongations and strengths of large welded specimens were generally inferior to those of small welded specimens. This seems to be caused by formal and metallurgical stress concentration. The creep rupture configuration of large welded specimens was very different from that of small welded specimens. The initiation of cracking in rupture occurred at the toe of the weld metal and at the intersection of the bonds on both sides of the weld metal. The cracking propagated along the grain boundary of the austenite of the bond in the heat-affected zone of the base metal. (auth)

8856 ON HETEROTYPE MIXED PHASES OF RARE EARTH OXIDES. III. THE TEMPERATURE INFLUENCE IN THE SYSTEMS ThO_2–Yb_2O_3 AND ThO_2–Eu_2O_3. K. A. Gingerich (Pennsylvania State Univ., University Park) and G. Brauer. Z. Anorg. Allgem. Chem., 324: 48-59(Aug. 1963). (In German)

The formation of anomalous mixed crystals in the systems ThO_2–Eu_2O_3 and ThO_2–Yb_2O_3 was investigated by means of x-ray powder diffraction. In both systems a marked influence of temperature on the range of solid solubility in the existent cubic phase was observed. Phase diagrams are given for the temperature range of investigation. The solubility of the sesquioxides in ThO_2 varies from 7.3 to 10 mole % $YbO_{1.5}$ and from 36 to 52 mole % $EuO_{1.5}$, respectively, depending on the temperature. (auth)

8857 DIFFUSION INVESTIGATIONS IN THE NIOBIUM–TUNGSTEN SYSTEM FOR POLYCRYSTAL, SINGLE-CRYSTAL, AND SPRAY COUPLES. II. SINGLE-CRYSTAL COUPLES. Erich Gebhardt and Kuno Kirner (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 54: 698-704(Dec. 1963). (In German)

The diffusion in couples of single crystals of tungsten and niobium was studied by means of the micro-hardness method. A number of annealed alloy buttons were hardness checked for a hardness versus concentration plot, which made it possible to convert the hardness values of the diffusion samples into concentration values. The single crystals used were combined in two columns with the sequence W⟨100⟩-Nb⟨100⟩-W⟨111⟩-Nb⟨110⟩-W⟨100⟩. One column was held in a tungsten tube furnace at 2100°C for times up to 390 hours with intervening inspections after 100 and 200 hours, respectively. The other column was held at 1900°C for times up to 500 hours with the intervening inspections after 112 and 212 hours, respectively. The diffusion coefficient for various concentration steps was calculated according to the Matano-Method. The coefficients for couples of single crystals proved to depend strongly on the concentration, i.e., in the same manner as they did for couples of polycrystalline tungsten and niobium. The diffusion coefficient for the single crystal couples held at 2100°C decreased from 1.4 to 1.9×10^{-6} cm^2/sec for 10 at.% W to 1.5 to 2.5×10^{-7} cm^2/sec for 90 at.% W. The corresponding values at the annealing temperature of 1900°C were 1 to 2×10^{-7} cm^2/sec for the concentration step 10 at.% W and 3 to 5×10^{-9} cm^2/sec for 90 at.% W. An influence of the orientation on the diffusion could not be observed because the strong concentration dependence overwhelmed fine deviations. (auth)

8858 CONSTITUTION DIAGRAM OF Ce–Gd ALLOYS. I. V. Burov, V. F. Terekhova, and E. M. Savitskii. Zh. Neorgan. Khim., 8: 2685-63(Dec. 1963). (In Russian)

Microstructure, thermal, thermomagnetic and x-ray analyses were made of Ce–Gd alloys, and a constitution diagram was constructed for various concentrations. The diagram exhibited a compound Ce_2Gd_5 (κ phase) with a samarium-type lattice. Parameters for κ-phase lattice along the rhombohedron axis were: a = 3.97 ± 1 Å and α = 23°21, and along the hexagonal axis a = 3.64 ± 1 Å and c = 26.27 ± 1 Å. The obtained data showed that in addition to valence electrons the constitution diagrams are also determined by f-shell electrons. (R.V.J.)

8859 PHASE RELATIONSHIPS IN THE URANIUM–CARBON–OXYGEN SYSTEM. John Valentine Hamme. Thesis, Raleigh, N. C., North Carolina State Coll., 1963. 97p.

An investigation has been made, primarily in the pseudo-ternary U–UC–UO_2 area, of the U–C–O system. A phase diagram is presented based upon a study of the furnace-cooled products formed at 1800 to 1850°C in both vacuum and inert gas. Using x-ray diffraction techniques, quantitative chemical methods, and metallographic examinations, the study reveals that a U(C,O) phase having the same structure as UC exists. The composition of the U(C,O) phase may be expressed as $U(C_xO_{1-x})$; however, there is evidence that the total C plus O atoms may be slightly greater or less than 50 at. %. The U(C,O) lattice parameter varies from approximately 4.963 A for the extrapolated value for UC to 4.952 A for $U(C_{.75}O_{.25})$, which repre-

sents the limit to which O replaces C in U(C,O) under these experimental conditions. The phase diagram, which shows the condensed phase relations, indicates that the following areas exist: a 2-phase $U(C,O)-UO_2$ area of divariant equilibria; A single-phase U(C,O) area of trivariant equilibria; a 3-phase $U-U(C_{.75}O_{.25})-UO_2$ area of univariant equilibria; and a 2-phase $U-U(C,O)$ area of divariant equilibria. Equilibrium conditions were established for the reaction $4\ U(C_{.75}O_{.25}) + UO_2 = 5\ U + 3\ CO$ at 5 temperature levels ranging from 1705°C to 1855°C. For the above reaction in this temperature range, the partial pressure of CO, expressed in microns of Hg, and the absolute temperature are related by the expression $Log_{10}P_{co} = 19.51 - 36{,}690/T$. (Dissertation Abstr.)

8860 MAGNETIC PROPERTIES OF TERBIUM–YTTRIUM, DYSPROSIUM–YTTRIUM, AND HOLMIUM–YTTRIUM SOLID SOLUTIONS. Sidney Irwin Weinstein. Thesis, Pittsburgh, Univ. of Pittsburgh, 1962. 108p.

The magnetic properties of the binary solid solutions of the systems Tb in Y, Dy in Y, and Ho in Y were investigated to determine the changes in these properties resulting from the differing atomic environment. Samples were prepared by levitation melting and were shown by x-ray diffraction to be single phase, hexagonal close packed, in the A3 type structure. Each system appeared to form continuous solid solutions over the entire concentration range. Thermomagnetic analyses were carried out between liquid He and room temperatures, and field dependencies were performed at liquid He, liquid N_2, and room temperature. Measurements were performed upon the pure lanthanons and upon alloys containing from 10 to 90 at. % Tb, 10 to 95 at. % Dy, and 10 to 80 at. % Ho. Results are reported and explained qualitatively in terms of the antiferromagnetic spiral structure, which is known to exist in the 3 pure lanthanons. (M.P.G.)

8861 STRUCTURAL AND MAGNETIC PROPERTIES OF SOME CUBIC LAVES PHASE INTERMETALLIC COMPOUNDS CONTAINING LANTHANIDES. Emanuel Andrew Skrabek. Thesis, Pittsburgh, Univ. of Pittsburgh, 1962. 136p.

Structural and magnetic determinations were made on intermetallic compounds of composition AB_2, where A is Y, Ce, Pr, Nd, Sm, Gd, Tb, Dy, Ho, Er, Tm, or Lu, and B is Fe, Co, or Ni. Except for $NdFe_2$ and $PrFe_2$, all of these compounds were found to exist in the $MgCu_2$ structure. The structures of these 2 compounds have not been determined, and they were not considered in the magnetic investigations $GdFe_2$ and $DyFe_2$ were not obtained as pure compounds, and their magnetic behavior was not examined. The structural data indicate that the lanthanides have smaller atomic radii than in the elemental state. In all 3 series of compounds, the Ce appears to be unusually small for the tripositive state. The magnetic data also indicate that the Ce may be more nearly quadripositive. All the other lanthanides and Y appear to be in the tripositive state. An antiferromagnetic alignment of the A and B moments was observed in the AFe_2 series. The magnetic data indicate that the 3d shells of the transition metals are more nearly full than in the elements themselves, especially in the ACo_2 and ANi_2 series, where these shells appear to be completely full or very nearly so. The observed magnetic moment of $SmNi_2$ is considerably higher than the value predicted on the basis of the behavior of the ANi_2 compounds. This is attributed to a possible inversion in the spin-orbit coupling scheme of the Sm. (Dissertation Abstr.)

8862 THE ELECTRONIC SPECIFIC HEATS OF THE PSEUDO-BINARY SYSTEM $TiFe_2-ZrFe_2$. Charles William Massena. Thesis, Pittsburgh, Univ. of Pittsburgh, 1962. 86p.

The electronic specific heats of 9 Laves phase alloys in the $TiFe_2-ZrFe_2$ system were measured in the range 1.5 to 4°K. The measurements were conducted in a calorimeter, in which no He exchange gas was used and which employed a mechanical heat switch to remove heat from the sample at low temperatures. The samples were prepared in 5 g quantities by levitation melting. A calorimetric sample consisted of many small pieces and required the use of a heat exchange medium for rapid achievement of thermal equilibrium. Glycerol was used for this purpose. Both the sample and the glycerol were placed in a container possessing a heater and a Ge thermometer. The heat capacity of the sample container and the glycerol were determined separately. The electronic specific heat coefficients for the 9 alloys were obtained from a least squares treatment of the heat capacity data. The density was determined from these coefficients. Magnetic and phase studies that had been conducted previously indicated a hexagonal ($TiFe_2$ structure) paramagnetic phase and a cubic ($ZrFe_2$ structure) ferromagnetic phase separated by a 2-phase ferromagnetic region. The measurements confirmed the previously determined phase boundaries and indicated a maximum in the density of states in each of the 2 phases. The density of states was higher in the paramagnetic hexagonal phase (maximum 1.969 states/atom-ev) than in the ferromagnetic cubic phase (maximum 0.656 states/atom ev). (Dissertation Abstr.)

Radiation Effects

Refer also to abstracts 8608 and 9265.

8863 (EURAEC-817) THE EFFECT OF RADIATION ON THE DUCTILE-BRITTLE TRANSITION IN PRESSURE VESSEL STEELS. Quarterly Report No. 11, July 1–September 30, 1963. E. Anderson, W. Bollmann, G. T. Hahn, D. King, M. Malone, and J. Spreadborough (Battelle Memorial Inst. International Div., Geneva). Oct. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 095-62-12-RDS. 27p.

Mechanisms by which ferritic pressure-vessel steels are embrittled by neutron irradiation are being studied. Lattice parameters of iron and iron alloys used in the program were determined by x-ray diffraction. Etch-pit studies of the dislocation structures at Lüders band fronts are reported. In fine-grained specimens the transition zone between undeformed and heavily deformed grains was quite sharp, while in relatively coarse-grained samples (540 grains/mm^2) the transition zone extended over about 20 grains. Many examples of partially deformed grains containing dislocations in rows parallel to the Lüders front were observed. (auth)

8864 (HW-69234) IRRADIATION EFFECTS ON URANIUM DIOXIDE MELTING. J. A. Christensen (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1962. Contract AT(45-1)-1350. 32p.

Irradiated uranium dioxide with exposures to 11.25 at.% uranium burnup was examined microscopically at temperatures to 3000°C. Melting temperatures were measured and mass vaporization rates compared for UO_2 with 14 different exposures. (auth)

8865 (HW-78388(p.6,1-9)) GAS-COOLED REACTOR STUDIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

A series of experiments is being conducted to determine the long-term radiation stability of graphite used as the moderator of the EGCR. Over the range 425 to 800°C a definite temperature effect was evident with samples irradiated at the higher temperature contracting at a lower rate. In creep studies on the irradiated graphite, measurements indicated that at exposures 75×10^{20} nvt, E70.18 Mev, there is no increase in length of the specimen. Impregnation of the graphite with furfuryl alcohol was found to enhance contraction. (M.C.G.)

8866 (HW-78388(p.8.1-7)) IRRADIATION EFFECTS ON MATERIALS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Precipitation at the grain boundaries in the Inconel pressure tube from the DR-1 in-reactor gas loop was attributed to temperatures attained during heat treatment or loop fabrication. The effects of temperature on the burst strength of Zircaloy-2 pressure tubes were studied. In-reactor creep tests were made on 20% cold-worked Zircaloy-2. Changes in mechanical properties of stainless steels with neutron flux were determined. Initial design of the Mark I test section from the model high-temperature gas loop was completed. In electron microscopy of irradiated graphite, broadening of microcracks in petroleum-coke filler was observed. The construction and bench testing of six controlled-temperature general swelling capsules were completed. Two were charged into a reactor for testing. Twenty-six NaK-filled capsules containing Zircaloy-2-clad rods of uranium and U–2 wt % Zr were discharged. Annealing irradiated thorium decreased its microhardness. Tensile properties of four Th–U alloys were determined. Errors in measurements were reduced by using depleted uranium instead of natural uranium as a fast flux monitor. Electron microscopic studies were made of deformed iron. (M.C.G.)

8867 (HW-SA-2909) IRRADIATION TESTING OF INJECTION-CAST Al–Pu–Ni ALLOY FUEL RODS. R. K. Koler, M. D. Freshley, and W. J. Bailey (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Feb. 8, 1963. Contract AT(45-1)-1350. 19p. (CONF-39-107)

From American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963.

A process was developed for the pneumatic-injection casting of 90-inch long, Al–Pu–Ni alloy fuel cores directly into cladding tubes within a glove box on a laboratory scale. Cast-bonded Al-2 wt % Pu-2 wt % Ni alloy, ½-inch diameter rods with 0.035-inch Zircaloy cladding were made with densities over 95 percent of wrought density and with clad-to-core bond shear strengths of 3000 to 4500 psi. Difficulty was encountered in meeting the specifications pertaining to plutonium distribution. This problem was in part due to equipment limitations and was not completely resolved. Fuel rod shortening was observed after both ex- and in-reactor tests. Post-irradiation metallographic examination indicated no significant microstructural changes in the fuel cores, hydriding of the cladding, or change in the core-clad reaction zone. Wire loosening was observed. Fretting corrosion was not observed. Satisfactory irradiation performance was demonstrated with Zircaloy-clad, Al–Pu–Ni alloy fuel rods, fabricated by pneumatic injection casting of the fuel alloy directly into the cladding. These rods generated maximum rod powers of 20 to 25 kw/ft with maximum surface heat fluxes in the range 460,000–588,000 Btu/hr-ft^2. Twenty to sixty percent burnups of the plutonium atoms were reached. The encouraging experimental results indicate that the fabrication method warrants further consideration as a potential remote reprocessing technique. (auth)

8868 (HW-SA-3268) INFLUENCES OF IRRADIATION ON FUEL ELEMENT CLADDING. J. C. Tobin (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 11, 1963. Contract AT(45-1)-1350. 38p. (CONF-380-1)

From 17th Meeting of the High Temperature Fuels Committee, San Ramon, Calif., Dec. 1963.

The factors involved in estimating the longevity of alloy components in a neutron radiation environment are discussed. Results are reported of studies conducted on the effects of neutron irradiation on Zircaloy-2, austenitic stainless steels (Types 304, 347, and 348), and Ni-base alloys (Inconel, Hastelloy X, and Inconel 702). General considerations in irradiation effects on mechanical properties of alloys are discussed, particularly defects and dislocations. Annealing and accumulation of damage are also considered. (D.L.C.)

8869 (LMSD-5029) NUCLEAR RADIATION EFFECTS ON INFRARED MATERIALS AND COMPONENTS. PART II. EFFECT OF GAMMA RADIATION ON LEAD SULFIDE INFRARED DETECTORS. F. A. Junga and R. S. Krogstad (Lockheed Aircarft Corp. Missile Systems Div., Palo Alto, Calif.). June 23, 1958. 27p.

Results of a study of cobalt-60 gamma radiation effects on the photoconductive properties of lead sulfide infrared detectors are presented. This investigation shows that detector performance begins to deteriorate almost immediately upon exposure to radiation. After a total gamma dose of 10^7 roentgens, the sensitivity is reduced to about 20% of its initial value. (auth)

8870 (NAA-SR-6262) IRRADIATION OF U–Mo BASE ALLOYS. M. P. Johnson and W. A. Holland (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). Jan. 30, 1964. Contract AT(11-1)-Gen-8. 34p.

A series of experiments was designed to assess the suitability of uranium–molybdenum alloys as high-temperature, high-burnup fuels for advanced sodium cooled reactors. Specimens with molybdenum contents between 3 and 10% were subjected to capsule irradiation tests in the Materials Testing Reactor, to burnups up to 10,000 Mwd/MTU at temperatures between 800 and 1500°F. The results indicated that molybdenum has a considerable effect in reducing the swelling due to irradiation. For example, 3% molybdenum reduces the swelling from 25%, for pure uranium, to 7% at ~3,000 Mwd/MTU at 1270°F. Further swelling resistance can be gained by increasing the molybdenum content, but the amount gained becomes successively smaller. At higher irradiation levels, the amount of swelling rapidly becomes greater, and larger amounts of molybdenum are required to provide similar resistance. A limit of 7% swelling, at 900°F and an irradiation of 7,230 Mwd/MTU, requires the use of 10% molybdenum in the alloy. The burnup rates were in the range of 2.0 to 4.0×10^{13} fission/cc-sec. Small ternary additions of silicon and aluminum were shown to have a noticeable effect in reducing swelling when added to a U–3% Mo alloy base. Under the conditions of the present experiment, 0.26% silicon or 0.38% aluminum were equivalent to 1 to 1½% molybdenum. The Advanced Sodium Cooled Reactor requires a fuel capable of being irradiated to 20,000 Mwd/MTU at temperatures up to 1500°F in metal fuel, or equivalent in ceramic fuel. It is concluded that even the highest molybdenum con-

tents considered did not produce a fuel capable of operating satisfactorily under these conditions. The alloys would be useful, however, for less exacting conditions. The U–3% Mo alloy is capable of use up to 3,000 Mwd/MTU at temperatures of 1300°F before swelling becomes excessive. The addition of silicon and aluminum would increase this limit to at least 3,500 Mwd/MTU, and possibly more if the alloy were heat treated to provide a fine dispersion of second phase. (auth)

8871 (NP-13503) STUDY OF RELIABILITY OF ELECTRONIC COMPONENTS IN A NUCLEAR RADIATION ENVIRONMENT. Reliability Engineering Document No. 8. W. B. Bartel (Battelle Memorial Inst., Columbus, Ohio). July 5, 1962. For California Inst. of Tech., Pasadena. Jet Propulsion Lab. 35p.

A radiation-effects study was conducted on capacitors and connectors. The capacitors studied included ceramic, glass or porcelain, metalized, mica, Mylar, paper, plastic, and electrolytic capacitors, while the connectors were of the miniature and subminiature types. (D.L.C.)

8872 (NP-13504) STUDY OF RELIABILITY OF ELECTRONIC COMPONENTS IN A NUCLEAR RADIATION ENVIRONMENT. (Battelle Memorial Inst., Columbus, Ohio). [1962]. For California Inst. of Tech., Pasadena. Jet Propulsion Lab. 50p.

A radiation-effects study was conducted on semiconductors, relays, inductors, transformers, fixed resistors, and variable resistors with reference to use in a nuclear-electric propulsion spacecraft. (D.L.C.)

8873 (NP-13505) STUDY OF RELIABILITY OF ELECTRONIC COMPONENTS IN A NUCLEAR RADIATION ENVIRONMENT. Final Report. (Battelle Memorial Inst., Columbus, Ohio). June 22, 1962. For California Inst. of Tech., Pasadena. Jet Propulsion Lab. 11p.

The operation of the following components in normal, radiation, and high-vacuum environments is evaluated: sensitive microswitches (single-pole double-throw), thermostats (bimetallic disc switch or temperature-sensitive mechanism), wires (coaxial cable and hook-up wire), and electron tubes (pentode-type, Raytheon Type 5886). Conclusions and recommendations are given for each component. (D.L.C.)

8874 (NYO-2937-1) RADIATION DAMAGE OF QUARTZ AND FUSED SILICA INDUCED BY HEAVY NEUTRON IRRADIATION. Final Report. Sigmund Weissmann (Rutgers Univ., New Brunswick, N. J. Coll. of Engineering). Jan. 1964. Contract AT(30-1)-2937. 5p.

Lattice defects in natural and synthetic quartz crystals exposed to 1×10^{19} to 1.5×10^{20} nvt of fast neutrons were studied by x-ray and transmission electron microscopy methods. A correlation was found between the clusters rich in interstitial Si atoms and the strain distribution, and the decrease in density is satisfactorily explained. Contrary to popular opinion, heavily irradiated quartz crystals still exhibit crystallinity, and the structures of heavily irradiated quartz and fused silica are different. The mechanism of the increase of the thermal conductivity of fused silica is considered. (D.L.C.)

8875 (REIC-ACCESS-69) MONTHLY ACCESSION LIST [ON RADIATION EFFECTS DATA]. Abstract Nos. 21127 to 21177. (Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio). Dec. 10, 1963. Contract AF33(615)-1124. 23p. (AD-425037)

Abstracts are presented of 51 articles which were accessioned and extracted for the REIC Technical Information File during Oct. 1 to Nov. 30, 1963. The abstracts are arranged into the following categories: metallic materials; ceramic materials; organic materials; polymeric materials; inorganic materials; electronic materials, components, and devices; space environment and effects on materials; experimental devices and techniques; and miscellaneous. An evaluation of the Dual Coordinate Index is included. (D.L.C.)

8876 (REIC-ACCESS-70) RADIATION EFFECTS INFORMATION CENTER MONTHLY ACCESSION LIST. Period Covered: December 1, 1963–December 31, 1963. Abstract No. 21254 to 21301. (Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio). Jan. 10, 1964. 27p.

Abstracts are presented of 48 articles which were accessioned and extracted for the REIC Technical Information File during the period covered. The abstracts are arranged into the following categories: metallics, ceramics, organics, polymerics, inorganics, electronics, space effects, and experimental devices and techniques. A coordinate index for the accession lists from Oct. 1 to Dec. 31, 1963, is also included. (D.L.C.)

8877 (EURAEC-816) REACTOR CASING STEELS. IRRADIATION OF STEEL SPECIMENS IN EL 3 AT DIFFERENT TEMPERATURES, AND POST-IRRADIATION TESTS. Special Report No. 2. (France. Commissariat a l'Energie Atomique, Paris). June 30, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 039-61-12 RDF. (A translation)

A study was made to determine the influence of the irradiation temperature on the tensile mechanical properties of different grades of steel, the fast neutron dose being 1.10^{19} nvt. Six successive irradiations were carried out in the EL3 and this account deals with the last of them. This irradiation covers only the AMMO (grade S) and DFOV (grade V) specimens and shows that: for the AMMO, there is definitely maximum hardening at an irradiation temperature of 130 to 140°C, and for the DFOV 4S, a plateau, if not a maximum, may exist around 250°C, but for this material the results are widely scattered. Isochronous restoration annealing (10 hr) was carried out on the AMMO. The yield strength is restored as from 250°C and this restoration appears to be independent of the irradiation temperature. During restoration, a secondary hardening seems to be produced around 300°C (for a 10 hr treatment). (auth)

8878 EFFECTS OF ANNEALING ON RADIATION-INDUCED LATTICE VACANCIES IN NATURAL GRAPHITE CRYSTALS. G. R. Hennig (Argonne National Lab., Ill.). Appl. Phys. Letters, 4: 55-6(Feb. 1, 1964).

Boron was introduced into graphite crystals as a substitutional impurity, and the crystals were cleaved. Examination by electron microscopy revealed the presence of numerous disk-shaped artifacts showing strong stacking-fault contrast. The disks were formed only if radiation damage was present. Annealing studies show the products of boron interaction with radiation damage prevent complete annealing of the crystals even at very high temperatures. (D.C.W.)

8879 THE EFFECT OF PRESTRESSING ON THE STRENGTH OF NEUTRON-IRRADIATED COPPER SINGLE CRYSTALS. T. J. Koppenaal (Argonne National Lab., Ill.) and D. Kuhlmann-Wilsdorf. Appl. Phys. Letters, 4: 59-61(Feb. 1, 1964).

Annealed crystals and crystals prestressed to various levels were subjected to neutron irradiation, and the yield stresses were subsequently determined. The increase of yield stress due to radiation damage was much higher for lower initial stress levels. Apparently, the yield stress in neutron-irradiated Cu single crystals is governed by the stress required to generate dislocations rather than that required to move existing dislocations. (D.C.W.)

8880 EFFECTS OF ELECTRON RAY FOR INSULATED PAPER. Teiichi Sakamoto and Yasunobu Yoshida (Nisshin Electric Co., Ltd., Japan). Denki Zasshi, 50: No. 6, 69-74(June 1963). (In Japanese)

To investigate the electron flux irradiation method of improving the dielectric characteristics of cellulose, a main component of insulating paper, experiments were carried out using an NS-type electron accelerator developed by the author. The sample used was a condenser insulating paper having an analytical composition of 87.8% α-cellulose (of polymerization degree 1700), 7.1% pentosan, 3.8% lignin, and traces of resins and ashes, with a thickness of 0.058 mm and density of 0.78 g/cm^3. Test pieces were irradiated at $10^4 \sim 10^5$ rad/s absorption dose rate. Properties of the samples irradiated in the range of $10^5 \sim 10^8$ rad and left in a desiccator at 20°C and relative humidity 65% for a week were tested. The results were as follows: (1) chemical changes occurred mainly in cellulose molecules, which were degraded producing alkaline soluble cellulose, and secondarily in a microstructure; (2) mechanical properties, especially anticracking of the samples, decreased corresponding to the degradation of cellulose; (3) dielectric characteristics, were improved by irradiation at $<3 \times 10^7$ rad, but deteriorated at $>3 \times 10^7$ rad. The improvements were considered to depend on the microstructural change in cellulose, and the deteriorations were thought to be caused by glucuronic acid and vanillin produced from cellulose and lignin decompositions. Chemical and mechanical deteriorations after irradiation were observed after some days in dry air, but in a moisture-containing atmosphere no deterioration was recognized. The phenomena were explained by the radical formation on the cellulose molecules. It was concluded that electron flux irradiation under suitable conditions can improve the dielectric characteristics of the condenser paper without using time drying. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8881 ON THE MECHANISM OF RADIATION DEFORMATION IN CRYSTALS. S. V. Starodubtsev and A. E. Kiv (Inst. of Nuclear Physics and Tech., Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 2, 41-3(1963). (In Russian)

Structural deformations induced by the passage of fast charged particles through ionic crystals were analyzed. A simultaneous ionization of neighboring particles results interatomic particle passage in times of 10^{-18} to 10^{-17} sec. K electron stripping in light atoms results in Auger transitions and multicharged atoms. Ionization cross sections for germanium bombarded by 100-kev electrons were estimated. It is shown that the shift cross section is $\Sigma \simeq 10^{-27}$ cm^2. (R.V.J.)

8882 ON CERTAIN MODELS OF RADIATION DEFECTS IN NON-CONDUCTING CRYSTALS. A. E. Kiv and S. V. Starodubtsev (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 41-3(1963). (In Russian)

The mechanism of atom shift in ionic crystals during the ionization of two neighboring atoms was analyzed previously for the case of $\tau_{life} < \tau_{rest}$. The probability of multi-ionized atoms results in a small shift cross section. However, in some cases one multi-ionized atom in a dielectric lattice produces a pair of neighboring ionized atoms. The situation arises when valence electrons of nearby atoms shift to multi-ionized atoms. In such a case the shift efficiency is determined by τ_{rest} because for valence shells $\tau_{rest} < \tau_{life}$. Multi-ionization takes place with a photoeffect on the k shell followed by Auger transitions, Compton effect on the k shell with Auger transitions, ionization in the k shell with Auger transitions, and direct multi-ionization of the valence shells. In the shift mechanism, electron jump to the multi-ionized atoms is considerably faster than to singly ionized atoms. From the mechanism considered, it was anticipated that in boron or hexagonal selenium crystals irradiated with 300 to 400 kev electrons the shift cross sections would be $\Sigma \simeq 10^{-24}$ to 10^{-25} cm; with 1-Mev photons, $\Sigma \gtrsim 10^{-27}$ cm. Experimental work with dielectrics indicates the presence of defects appearing in the shape of positively charged channels along the ionizing particle track. It was assumed that the track is related to the electrostatic field focusing produced by the positive channels. (R.V.J.)

8883 CALCULATIONS OF THE NUMBER OF DEFECTS PRODUCED BY FAST ELECTRONS. S. V. Starodubtsev and A. E. Kiv (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 4, 53-8(1963). (In Russian)

An analysis was made of crystal defects produced by fast electron bombardment, considering crowdion defects with somewhat different thresholds and defects produced by incident electrons transmitting energy to an atom during dynamic crowdion formation. (R.V.J.)

8884 EFFECT OF FAST NEUTRONS ON THE TRANSPORT PROPERTIES OF GERMANIUM. Nguyen Van Dong and Pham Ngu Tung (Centre d'Etudes Nucléaires, Saclay, France). J. Electron. Control (1), 15: 547-60(Dec. 1963). (In French)

The nature and properties of the defects produced in Ge by fast neutrons are determined by measurements of the thermal conductivity, the Seebeck coefficient, the electric resistivity, and the Hall coefficient at 80 to 300°K. A predominance of acceptor levels is noted, which is attributed to the existence of surplus vacancies. Defects having large dimensions are also observed. Annealing at high temperatures causes these large-scale defects to disappear readily, while the surplus vacancies are far more stable. (T.F.H.)

8885 THE IRRADIATION-INDUCED PHASE TRANSFORMATION IN ZIRCONIA. J. Adam and B. Cox (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nucl. Energy, Pt. A & B, 17: 435-6(Dec. 1963).

Previous publications on phase changes in ZrO_2 are reviewed, and disagreements on interpretation are resolved. (R.E.U.)

8886 RADIATION VULCANIZATION OF HETEROSILOXANE RUBBERS. S. V. Aver'yanov, I. Ya. Poddubnyi, L. A. Aver'yanova, and Yu. V. Trenke. Kauchuk i Rezina, No. 8, 1-7(1963).

Vulcanizates with the best physicomechanical properties (tensile strength, 34–133 kg/cm^2; elongation, 80–150%; residual elongation, 3–4%) were produced by γ irradiation (doses, 2.2–5.6 Mr) of 0.15% vinyl group-containing heterosiloxane rubber mixes containing compounds of polyvalent metals [unspecified] and filled with Aerosil, under vacuum. The heat resistance of radiation vulcanizates of the heterosiloxane polymers considerably surpassed that

of radiation vulcanizates of pure or vinyl group-containing polydimethylsiloxanes (SKT and SKTV rubbers). Vulcanizates produced by γ irradiation in air of polyborophosphorosiloxane rubber mixes containing polyvalent metal compounds and Aerosil retained satisfactory physicomechanical properties after heat aging in air for 3 hr at 400°C or 5 min at 430°C, or in the absence of air for 1.5 hr at 450°C, 40 min at 500°C, or 5 min at 570°C. The enhanced heat resistance of polyheterosiloxane vulcanizates can be attributed to the stopping, by hetero atoms, of degradation by the free radical chain mechanism at 390–420°C or to intramolecular stabilization by hetero atom-containing groups of reactive intermediate products formed during heat aging. Radiation vulcanizates of heterosiloxane polymers exhibited good low-temperature and radiation resistance and retained their hardness after heat aging in the absence of air. They are characterized by autohesion and by high adhesion to metals (4.4–5.4 kg/cm^2). (TCO)

8887 DIFFICULTIES IN OBTAINING UNIFORM DOSE DISTRIBUTION THROUGHOUT ELECTRON-IRRADIATED PLASTIC MOULDINGS. J. D. McCann and F. Rogers (United Kingdom Atomic Energy Authority, Wantage, Berks, Eng.). Nature, 200: 1195-6(Dec. 21, 1963).

The spread of indicated dose in the electron irradiation of complicated moldings with inserts of various materials was studied using a self-adhesive paper with a radiation-sensitive coating. The spread could be reduced using a forward-scattering foil and a back-scattering plate over the sample support tray. Best results were obtained using a 0.5-mm Al foil and a 1.5-mm Pb plate; the dose ratio was 1:2. (D.L.C.)

8888 DIELECTRIC LOSS FACTOR OF POLYTETRAFLUOROETHYLENE UNDER IRRADIATION. V. Adamec (Výskumný Ústav Káblov a Izolantov, Bratislava). Nature, 200: 1196(Dec. 21, 1963).

Measurements of the dielectric permittivity and dissipation factor of polytetrafluoroethylene were carried out under x-irradiation. The dissipation factor begins to rise with dose rate, while the dielectric permittivity remains nearly constant. Loss factors were calculated and are plotted for dose rates of 0.01 to 100 r/sec. The results indicate that the variation in the loss factor with dose rate is not caused solely by the rise of steady-state conductivity. (D.L.C.)

8889 CONDUCTIVITY INDUCED BY CATHODE RAYS IN CADMIUM-SELENIDE LAYERS. A. Bril and W. G. Gelling. Philips Res. Rept., 17: 329-36(Aug. 1962).

Measurements were carried out on the conductivity induced by electron irradiation of cadmium-selenide layers. The layers were prepared by evaporation of cadmium selenide while afterwards an amount of Cu was evaporated onto the layer in order to activate it. The gain of the induced current with respect to the primary current of the electron beam was determined as a function of the voltage applied to the layer for 10-kv, 15-kv, and 20-kv electrons; a gain of more than 2000 was found. The dependence of the gain on the primary current and the decay of the induced current were measured, the latter being 0.25 msec. (auth)

8890 SECONDARY-ELECTRON YIELD ON COPPER–BERYLLIUM FOR H^+, H_2^+, H_3^+, H^0, H_2^0, AND H_3^0. E. S. Chambers (Univ. of California, Livermore). Phys. Rev., 133: A1202-7(Feb. 17, 1964). (UCRL-7421)

Experimental secondary-electron yields for H^+, H_2^+, and H_3^+ incident on copper–beryllium at 60° increase continuously from about 3 at 2 kev to 5.9 at 55 kev for H^+; to 8.5 at 55 kev for H_2^+; and to 10.8 at 55 kev for H_3^+. At an angle of incidence 0–72° corresponding values are about 1.7 times larger. Thus the yield increases approximately as sec θ. The ratio of yield δ_0 for neutral particles (obtained by charge transfer) to yield δ_1 for ions was determined by a calorimetric measurement of the incident beam power. Neutrals yield more electrons than ions, and the ratio is only slightly dependent on energy. At 25 kev, the ratio δ_0/δ_1 is 1.14 for H^+, 1.26 for H_2^+, and 1.41 for H_3^+. The secondary-electron and positive-ion energy spectra were measured for both neutrals and ions. The two types of particles gave the same spectra. The atomic stopping cross section for protons and copper was extrapolated down to 2 kev. (auth)

8891 THE RECOVERY OF IRON AFTER COLD WORKING OR NEUTRON IRRADIATION BETWEEN 20 AND 450°C. F. Bell and O. Krisement (Max-Planck-Institut für Eisenforschung, Düsseldorf). Phys. Status Solidi, 3: 2241-52(1963). (In German)

The recovery of cold-worked or neutron-irradiated pure iron was investigated using stored-energy measurements over the temperature range 20 to 450°C. In both cases a single recovery stage was found, which lies in the same temperature range for both types of treatment. On the basis of the experimental results, and a comparison with other bcc metals, the nature of the defects that anneal out in the observed recovery stage is discussed. (auth)

8892 DISACCOMMODATION AND FREQUENCY DEPENDENCE OF THE MAGNETIC AFTER-EFFECTS AT HIGH TEMPERATURE IN IRON–SILICON SYSTEMS. II. EXPERIMENTAL INVESTIGATION. E. Balthesen (Kernforschungsanlage, Julich, Ger.). Phys. Status Solidi, 3: 2321-35(1963). (In German)

Measurements were made between 400 and 700°C on materials with 1%, 2%, and 3% by weight Si. The relaxation times were found to be inversely proportional to the square of the Si concentration. It did not appear to be possible to explain the experiments by the orientation of atomic pairs. However, the measurements agreed quantitatively with the theory of vacancy diffusion. The results indicated that the crystal anisotropy of Si–Fe alloy depends very strongly on the Si concentration. Results of in-pile measurements are also reported. (auth)

8893 IRRADIATION DAMAGE IN BERYLLIUM OXIDE. F. J. P. Clarke (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 221-48(1963).

The dimensional, mechanical, and thermal effects of reactor irradiation of beryllium oxide are discussed. Gas production by transmutation and its role in these changes are considered. A state-of-knowledge summary is presented. (R.E.U.)

8894 PULSED RADIATION EFFECTS ON AEROSPACE DIGITAL COMPUTERS. P. J. Sykes, Jr. RTD Technol. Briefs, 2: No. 11, 21-2(Jan. 1964).

Digital computer programs were developed and applied to analyze and predict the responses of electronic circuits to the transient nuclear radiation pulses characteristic of nuclear weapon bursts. In conjunction with experimental studies of the effects of pulses of radiation on typical aerospace digital computer circuits, elemental transistor circuits, and various electronic components, these analytic programs were applied to determine the transient radiation responses of aerospace digital computer circuits used in the TITAN II and SINGS computers. The results may be

used to assign the maximum level of pulsed nuclear radiation that these computers can withstand and still operate satisfactorily. The results of this effort are classified Secret, and published in RTD TDR 63-3051. (auth)

8895 CONCERNING PHOTOCONDUCTIVITY SPECTRA OF n-TYPE SILICON IRRADIATED BY FAST ELECTRONS. V. D. Tkachev, A. F. Plotnikov, and V. S. Vavilov (Lebedev Inst. of Physics, Moscow). Soviet Phys.-Solid State (English Transl.), 5: 1332-5(Jan. 1964).

The effect of electron irradiation on the photoconductivity of n-type silicon with various initial conductivities was investigated. Additions were made to the energy level system of defects in silicon. (auth)

8896 ON DEFECTS PRODUCED BY γ RAYS IN GERMANIUM. N. A. Vitovskii, B. M. Konovalenko, T. V. Mashovets, S. M. Ryvkin, and I. D. Yaroshetskii (Leningrad Inst. of Physics and Tech.). Soviet Phys.-Solid State (English Transl.), 5: 1338-44(Jan. 1964).

An attempt is made to explain the distinctive features of the behavior of n- and p-type germanium following irradiation with γ rays and annealing of the irradiated samples. In the explanation, the idea of monopolar and bipolar annealing of defects is used. (auth)

8897 ENERGY LEVELS IN GERMANIUM INDUCED BY FAST-NEUTRON BOMBARDMENT. R. F. Konopleva, S. R. Novikov, and S. M. Ryvkin (Leningrad Inst. of Physics and Tech.). Soviet Phys.-Solid State (English Transl.), 5: 1345-52(Jan. 1964).

The temperature dependence of the Hall effect was used to investigate the spectra of levels appearing in Ge that was irradiated by fast neutrons. The irradiation was performed in reactor channels where the temperature was about 70°C. Five levels located in the forbidden gap of Ge were observed and their introduction rate was determined. It is shown that the three lower levels turned out to be acceptors. These results were compared with the James–Lark-Horovitz defect model. The possible effect of a disordered region on Hall constant measurements was examined. (auth)

8898 INFRARED TRANSMISSION OF NEUTRON-IRRADIATED INDIUM ANTIMONIDE. N. I. Kurdiani (Tbilisi State Univ., Georgian SSR). Soviet Phys.-Solid State (English Transl.), 5: 1477-8(Jan. 1964).

In Sb crystals were irradiated with neutrons at room temperature. The infrared transmission was measured in the wavelength range 17-5 μ. At 100°K the transmission of the irradiated crystals was 10% greater than the transmission of the unirradiated samples at the same temperature. This increase of transparency is discussed. (C.E.S.)

8899 CORROSION OF COPPER IN SULFURIC ACID UNDER γ-RAY IRRADIATION. Hidehiro Goto (Tohoku Univ., Sendai), Shin Suzuki, and Yasushi Inoue. Trans. Japan Inst. Metals, 4: 102-8(Apr. 1963).

In order to illustrate the corrosion behavior of metals under radiation, a study was begun of the corrosion of pure metals in mineral acid under γ irradiation. The results of experiments on the corrosion of copper in sulfuric acid are presented. Irradiation cells containing sulfuric acid in the desired concentration in which pure copper plate was immersed were irradiated using a Co^{60} γ source, the specimen was removed from the sulfuric acid and weighed to determine the weight loss; if necessary, the surfaces of the specimens were examined photographically, or by the x-ray or electron diffraction method, and the corrosion products were chemically analysed. The test results were compared with those of reference runs conducted under the same conditions minus irradiation. The effect of radiation was pronounced above the total dose of 10^7 r. The loss of weight became greater with higher acidity up to 5N and then decreased, reaching a minimum at 20N. But in concentrated sulfuric acid weight loss was remarkable and a dark green corrosion product was precipitated which was assumed to be composed of CuS. The effect of radiation was mainly due to the decomposition of sulfuric acid but not to effects on the nature of the metal itself. The results are discussed from the standpoint of the radiolysis of sulfuric acid solution. (auth)

8900 EFFECT OF RADIATION ON CORROSION PROPERTIES OF METALS AND ALLOYS. A. V. Byalobzheskii, V. D. Val'kov, and V. N. Lukinskaya. p.332-40 of "Deystviye Yadernykh Izlucheniy na Materialy." Moscow, Academy of Sciences, 1962.

The electrochemical properties of a number of materials which were directly exposed to x rays or a stream of fast electrons were studied. Results showed that a radiation-electrochemical effect and the formation of energetic polarizers play a decisive role in accelerating corrosion. Radiolysis products of water (H_2O_2, O_2, OH, and HO_2) also play a big part in corrosive action. When an oxide film is present on a metal, a photochemical effect, an increase in the number of current carriers in the film, may appear. In some cases, radiation stops corrosion processes. (Ref. Zh.-Met. 8, Aug. 1963)

8901 EFFECT OF IONIZING RADIATION ON ELECTRIC CONDUCTIVITY OF POLYCRYSTALLINE BORON. M. Usmanova. p.160-3 of "Radiationnaya Effektyunost v Tverdykh Telakh." Tashkent, Izd. AN Uzb. SSR, 1963.

The effect of γ radiation on the resistivity of polycrystalline boron was studied on specimens prepared from 97.65% pure boron powder sintered under a vacuum of 1.5×10^{-7} mm Hg with temperature slowly raised to 1350°C. Sintering was repeated until resistivity reached a constant value of about 2 ohm · cm. X-ray diffraction patterns of sintered specimens showed that they have a polycrystalline fine-grained structure. Gamma radiation significantly reduced boron resistivity. The sharpest decline of resistivity occurred after irradiation by doses of as much as 350 million r; further increase of doses changed the resistivity much less. In the first 5 days following irradiation, the resistivity gradually increased, but it never reached the original (prior to irradiation) value. (OTS)

8902 KORROZIYA I OBLUCHENIE. (Corrosion and Irradiation). V. V. Gerasimov, A. I. Gromova, E. S. Golovina, G. S. Moskvichev, F. S. Pavlova, V. V. Smirnov, and E. T. Shapovalov. Moscow, Gosatomizdat, 1963. 272p.

Corrosion and protection of construction materials used in reactors, reactions of reactor radiations with the material, and effects of radiation on corrosion and electrochemical behavior of metals are discussed. (R.V.J.)

8903 RADIATION EFFECTS ON GLASS. P. S. Rudolph (Oak Ridge National Lab., Tenn.). p.114-23 of "PROCEEDINGS OF THE EIGHTH SYMPOSIUM ON THE ART OF GLASSBLOWING." Wilmington, Del., The American Scientific Glassblowers Society. 1963.

A review is presented on the effects of high energy radiations on various types of glass. The principles involved are briefly discussed. (P.C.H.)

8904 ION BOMBARDMENT AND ITS EFFECTS ON THE OPTICAL PROPERTIES OF METALS. Donald L. Anderson (Ames Research Center, Moffett Field, Calif.). 19p. (CONF-209-18)

From American Vacuum Society Meeting, Boston, Oct. 1963.

The radiative energy balance between a space vehicle surface and its environment is investigated to study temperature control inside the vehicle. This energy balance is related to the absorptance and emittance of the vehicle surface. Surfaces of Ti–Al–V alloys, pure Al, and electrolytic Cu are subjected to sputtering by hydrogen ions. Measurements on the changes in absorptance to emittance ratios due to sputtering are then made for an optical beam of 0.3 – 3.0 μ wavelength, which covers the solar spectrum of interest. (C.E.S.)

8905 PREDICTING THE EFFECT OF NEUTRON IRRADIATION ON THE MECHANICAL PERFORMANCE OF REACTOR VESSELS. A. B. Holt (Atomic Energy Commission, Washington, D. C.). New York, American Society of Mechanical Engineers, 1963, Paper No. 63-WA-135, 6p. (CONF-102-19)

From American Society of Mechanical Engineers 1963 Winter Meeting, Philadelphia, Nov. 1963.

Calculations are presented for predicting the effects of fast neutrons on the crack arresting temperature of reactor pressure vessels. (C.E.S.)

8906 BERYLLIUM DAMAGE IN THE MATERIALS TESTING REACTOR–EXPERIMENTAL AND ANALYTICAL INVESTIGATIONS. PART I. OBSERVATIONS. J. W. Dykes. 15p. (CONF-243-44)

From American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, Oct. 1963.

A description is given of the beryllium reflector of the MTR with observations of first damage and of the present condition of the reflector. (R.E.U.)

METEOROLOGY

8907 (HW-SA-3192) FORECASTING DISPERSION FROM A SOURCE NEAR GROUND LEVEL. C. L. Simpson, J. J. Fuquay, and W. T. Hinds (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 29, 1964. Contract AT(45-1)-1350. 14p. (CONF-173-3)

From Symposium on Ceramics in Aerospace Technology, Los Angeles, Jan. 1964.

Hanford ground source diffusion data have shown the importance of both wind direction variability and atmospheric stability in determining the level of exposure due to a ground release. The cross-wind spread of a plume has been expressed solely as a function of wind direction variability and mean wind speed through the parameter $\sigma_\theta \bar{U}$. The decrease in (normalized) peak exposure with time has been shown to depend upon $\sigma_\theta \bar{U}$ as well as atmospheric stability. Thus, the plume from a ground source has been described in terms of temperature distribution and wind velocity. Verification of the technique out to eight miles from the source point has been encouraging, and it appears that this method holds promise for a variety of uses, both theoretical and applied. (auth)

8908 (SC-DC-3553(p.209-18)) METEOROLOGICAL STUDIES AS RELATED TO AEROSPACE NUCLEAR SAFETY. Isaac Van der Hoven (Weather Bureau, Washington, D. C.).

The meteorological aspects of the environmental problem in the use of nuclear rocket engines at or near the launch pad before flight are discussed. The hazards evaluation for static tests is based on the initial source configuration, the mean atmospheric transport, and the effects downwind, at the surface, of atmospheric diffusion, and deposition. (R.E.U.)

8909 THE METEOROLOGY OF THE MEXICAN REPUBLIC AND ITS RELATION TO THE PROGRAM OF RADIOLOGIC PROTECTION. I. G. Galindo Estrada (Comision Nacional de Energia Nuclear, Mexico City). Com. Nacl. Energia Nucl. (Mex.), [Publ.], No. 131: 1-15 (Nov. 1963). (In Spanish and English)

The meteorologic situation prevalent over the Mexican Republic, its synoptic situations and the relation between them and the profiles of fallout are analyzed. The mechanism by which the particles are injected into the tropopause and its meteorological significance are discussed. It is shown that in spite of the peculiar orography of the Mexican Republic, Synoptic Meteorology is a valuable instrument for the interpretation of the increase of radioactivity and the possible paths of radioactive debris over the country. (P.C.H.)

8910 METEOROLOGICAL PROCESSES IN THE TRANSPORT OF WEAPON RADIOIODINE. L. Machta (U. S. Weather Bureau, Washington, D. C.). Health Phys., 9: 1123-32(Dec. 1963).

Analysis of the I^{131} content of milk sampled by the Public Health Service Pasteurized Milk Network between September 1, 1961 and January 1, 1963, indicate that there have been eleven incidents in which milk was contaminated in excess of an arbitrarily chosen 300 pC/l. Three distinct meteorological processes are invoked to account for the transport of I^{131} in these cases from source to milkshed. First, two cases, one affecting Spokane, Washington, and a second Salt Lake City, involved the drift of nuclear clouds from low altitude releases of radioiodine from the Nevada Test Site. Second, there were two cases in which debris was brought to the surface along the southern edge of a high pressure system. The first of these two cases involved debris released at the Novaya Zemlya proving grounds, and the second, debris from the central Asian proving grounds. Both resulted from the subsidence of air masses, bringing the associated debris to lower altitudes. The final mechanism for the deposition of I^{131} is precipitation scavenging. One case deals with debris scavenged from either the upper reaches of the troposphere over the central United States, the debris having originated some 4 days earlier over Christmas Island. The seven instances of precipitation scavenging confirm the dominance of this deposition mechanism. The macro features of transport and deposition of radioactive debris rather than the micro mechanisms of uptake or deposition are discussed. (auth)

PHYSICS

General

8911 (63-RL-3382E) NONTHERMAL IONIZATION IN AN ELECTRODELESS DISCHARGE IN HELIUM SEEDED WITH CESIUM. R. Kristal and D. J. BenDaniel (General Electric Co. Research Lab., Schenectady, N. Y.). July 1963. 51p.

The creation of a highly conducting gas at low temperatures, the process designated nonthermal ionization, was investigated. Helium, at ambient pressures of 0.1 atm and 0.05 atm seeded with cesium vapor in varying degrees in the range 10^{13} to 10^{16} atoms/cm^3, was used. The method of creating high conductivities and for measuring the properties of the resulting gas is described. R-f energy was coupled inductively into the discharge chamber and caused ionization of the cesium vapor. The resulting highly ionized plasma was maintained for about a millisecond, the duration of the pulse of r-f energy. Plasma voltage and current data were observed and recorded, for various cesium seedings, at different times during the pulse. The results are compared with theoretical predictions. The necessary first order theory required to predict the properties of the discharge is reviewed. The Maxwellian velocity distribution function for the electrons is used in all calculations, with electron temperature corresponding to the magnitude of existing electric field. The gas atoms, unaffected by the applied electric field, warm up slowly and only by collisions with the hot electrons liberated from the easily ionized cesium atoms. Measurements are made soon enough so that this gas heating is not appreciable. A corrected form of the Saha equation is used to calculate electron density. This takes into account the degree of optical transparency of the discharge. The theory predicts that conductivities of the order of 20 mho/m at 0.1 atm and 40 mho/m at 0.05 atm be established in times of the order of 50 μsec for current densities of the order of 2 amp/cm^2. These predictions are borne out within a factor of two, which is considered reasonable agreement. The general shape of the characteristic curves is found to be similar to that expected. Variation of voltage level with cesium seeding was found to contradict theory at the lower pressure and high cesium concentrations. In most cases, observed conductivities are smaller than those predicted. These are considered the result of energy loss mechanisms unaccounted for in the first order theory. (auth)

8912 (HW-78388(p.10.1-25)) PHYSICS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Design of the High Temperature Lattice Test Reactor was completed. Experiments with Pu–Al alloys containing nominal 2.2 wt % Pu with 20.62 ± 0.12 at. % Pu^{240} were conducted in the PCTR. The effect of exposure and Pu^{240} concentration on plutonium reactivity was studied. Pu–Al alloys with 6.25, 16.33, and 27.17% Pu^{240} were irradiated to 2×10^{21} nvt. Diffusion theory and perturbation calculations for reactivity measurements in the PRCF are discussed. The program to measure or remeasure the total cross sections of all available elements and separated isotopes for neutrons with energies of 3 to 15 Mev was continued with 31 additional measurements. Experiments to measure the slow-neutron scattering law $S(\alpha,\beta)$ of light water at 95°C were completed under conditions of moderate energy resolution. A neutron spectrometer is being developed to measure the double-differential scattering cross sections for initially monoenergetic neutrons. Control rod calculations were made for plutonium-fueled thermal reactors. (M.C.G.)

8913 (IA-841) DIFFERENTIATION BETWEEN ATOM AND ION SPECTRA OF URANIUM (4217.77–4704.48A) AND OF EUROPIUM (2398.92–2658.41A) USING ONLY A DC ARC AS EXCITATION SOURCE. S. Held (Israel. Atomic Energy Commission. Soreq Research Establishment, Rehovoth). Apr. 1963. 48p.

The differentiation between atom and ion spectra of uranium in the spectral range 4217.77 to 4704.48A and of europium in the range 2398.92 to 2658.41A was made using only a d-c arc as the excitation source. The reliability of the method was confirmed by comparing with data in the literature. The method presents an additional aid for distinguishing between atom and ion spectra of the rare earths in the ultraviolet spectral region shorter than that obtained in a King furnace. Some results are also given for samarium spectrum in the short wave region. (auth)

8914 (K-1584) SCATTERING OF MOLECULES FROM SURFACES: THE EFFECT OF APPARATUS MISALIGNMENT ON THE DIRECTION AND INTENSITY OF INCIDENT AND SCATTERED MOLECULES. J. C. Crews (Oak Ridge Gaseous Diffusion Plant, Tenn.). Jan. 14, 1964. Contract W-7405-eng-26. 21p.

Matrix and vector methods were used to develop a technique for computing the effect of misalignment on the direction of incident and scattered beams, and on the measured intensity of scattering from a surface. The analysis developed was used in an IBM 7090 data reduction program. (auth)

8915 (LAMS-3002) STATUS REPORT ON OPACITY CALCULATIONS. Walter F. Huebner and Robert S. Stuart (Los Alamos Scientific Lab., N. Mex.). Nov. 1, 1963. Contract W-7405-eng-36. 75p.

The results of a survey in the opacity field have been compiled and are presented categorized according to the various phases of an opacity calculation. The categories considered include: energy levels, wave functions, electronic occupation, bound-free transitions, free-free transitions, bound-bound transitions, scattering, molecular transitions and complete opacity calculations. A list of scientists recently active in one or more of these fields is included. (auth)

8916 (PR-P-59) PHYSICS DIVISION PROGRESS REPORT, JULY 1 TO SEPTEMBER 30, 1963. (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.). 82p. (AECL-1871)

Separate abstracts were prepared for each of the five sections. (D.C.W.)

For abstracts of individual sections see: 8614, 8917, 8918, 8919, and 9317.

8917 (PR-P-59(p.4-20)) NUCLEAR PHYSICS BRANCH. G. C. Hanna (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.).

Fission studies were undertaken, and Swiatecki's semi-empirical mass formula was modified to improve the fit to observed masses. The energy loss rates for several heavy ions in various elements were also determined, and a relation between the loss rate and the mean square charge

was examined. The reliability of the Doppler shift attenuation method (DSAM) for measuring the lifetimes of excited states of medium mass elements was demonstrated, and the DSAM was used to remeasure the lifetimes of the first four Ne^{20} excited states. Additionally, energy levels and transitions in Ne^{20} were studied by angular correlation measurements for the reaction $C^{12}(C^{12},\alpha)Ne^{20}$. Analysis of angular correlations from $C^{12}(C^{12},\alpha\gamma)Ne^{20}$ is discussed. Spins and amplitudes for the 3.34 and 4.47-Mev Ne^{22} levels were also studied by γ-γ correlation measurements, and the spin-parity assignment of Mg^{24} levels below 9.6 Mev was investigated. (D.C.W.)

8918 (PR-P-59(p.21-36)) GENERAL PHYSICS BRANCH. H. Carmichael (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.).

The operation and development of cosmic neutron monitors continued, and three methods for correcting cosmic meson monitor counting rates for atmospheric temperature variations were evaluated. An estimate of the atmospherically induced diurnal variation in the meson rate was also obtained. The high-energy gamma spectrum of Yb^{177} was measured with a Li-drift Ge gamma spectrometer with a resolution of 6 kev at 1-Mev energies. Modification of the disintegration scheme resulted. Additionally, the conversion electron spectrum of Gd^{159} was measured using an isotope-separated Gd^{159} source. Radioisotope standardization work included 4π β-γ measurements for Co^{60}, 4π α and 4π α-γ measurements for Am^{241}, and determination of the branching ratio in Cs^{137} decay. Development of gas counters and semiconductor detectors is summarized. (D.C.W.)

8919 (PR-P-59(p.65-78)) THEORETICAL PHYSICS BRANCH. H. H. Clayton (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.).

Research progress on the many nucleon problem, neutron strength functions, optical model calculations, energy levels and transitions, lattice vibrations, charged particle focusing by axially symmetric magnetic fields, energy deposition and fast neutron flux in annular U fuel elements, neutrons from inelastic proton scattering, and thermal utilization is summarized. Computer programming and use are also covered. (D.C.W.)

8920 (TID-19940(p.119-39)) THEORETICAL PROGRAM. (Minnesota. Univ., Minneapolis. Linear Accelerator Lab.).

Developments in field theory, elementary particle physics, nuclear theory, many-body theory, quantum mechanics, and scattering are summarized. Activities in the summer program are also included. (D.C.W.)

8921 (TID-20020) THE ELECTRICAL CHARGING OF SMALL PARTICLES AT LOW PRESSURES. Progress Report No. 1, January 15, 1963–September 15, 1963. B. Y. H. Liu and K. T. Whitby (Minnesota. Univ., Minneapolis). Oct. 1, 1963. Contract AT(11-1)-1248. 43p.

Existing charging theories are reviewed, and the experimental system, charge spectrometer, particle charges, and small ion mobility analyzer, which were constructed specifically for these studies, are described. Some preliminary charging data obtained for particles of 0.083 micron mass median diameter at 1.0, 0.1 and 0.01 atmosphere are also included. These data indicate that the particle charge is substantially higher than the existing charging theories predict. (auth)

8922 THE GENERATION OF HIGH MAGNETIC FIELDS. D. C. Doughty and H. J. Goldsmid (General Electric Co. Ltd., Wembley, Eng.). Brit. Commun. Electron., 10: 776-81(Oct. 1963).

A survey is presented of both conventional and superconducting means of generating steady high-intensity magnetic fields. Applications are discussed. 14 references. (R.E.U.)

8923 THE DIFFUSION DEPTH FOR ELECTRONS IN SOLID TARGETS. V. E. Cosslett (Univ. of Cambridge, Eng.). Brit. J. Appl. Phys., 15: 107-9(Jan. 1964).

The diffusion depths experimentally found for 20-kev electrons in four elements (Al, Cu, Ag, Au) are about twice the values predicted by Archard. The discrepancy is reduced by using recent computations of the transport mean free path in the derivation, but an alternative treatment by Tomlin gives still better agreement. (auth)

8924 EXPERIMENTS ON MHD SHOCK WAVES IN T-SHAPED SHOCK TUBE. Motokazu Uchida (Hitachi Ltd., Japan). Bull. Aeronaut. Res. Inst., Univ. Tokyo, 3: (Special Issue) A70-9(Sept. 1963). (In Japanese)

Shock-wave velocity measurements were made using a small T-shaped shock tube (30 mm ID) with and without a solenoidal magnetic field on the expansion chamber. Energy was stored in a bank of the 5-μf 15-kv capacitors. Air, argon, and helium were used for a test gas. The attenuation of the shock velocity along the expansion chamber was measured by a streak camera, and the results were compared with the one-dimensional blast wave theory. By the wave-speed photographs of reflected shock wave, measurements were made on the ratio of the speed of reflected shock wave to that of the incident one and the duration of the uniform flow region behind the shock front. Preliminary experiments show that the duration, which is between one and two microseconds over the whole length of the expansion chamber, increases when the magnetic field is applied. They also show that intensity of radiation from the hot gas behind a shock wave decreases in a magnetic field. (Nucl. Sci. Abstr. Japan, Vol. 2, No. 4)

8925 MAGNETIC DEFLECTION OF ELECTRON BEAMS AND CAUSTIC PATTERNS. Koichi Kanaya, Hisazo Kawakatsu, Ikio Okazaki, and Tadao Takizawa. Denki Shikensho Iho, 27: 401-17(June 1963).

Deflection equations of electron beams passing through a magnetic field are formulated by taking account of the bell-shaped field distribution along the optic axis as well as the vertical and horizontal directions so that a practical understanding of the magnitude of deflection, position of principal plane, slope of deflected beam, aberration constants, etc., is obtainable. It is experimentally confirmed that the field distribution of a magnetic deflector, which consists of parallel plate-poles magnetized by the exciting current, can be approximated to a straight line in a region far from the edge of poles, and that the deflection can be estimated from the characteristic angle and deviation of the principal plane. The aberration constants of magnetic deflection with fringing effects, which is expressed only by functions of the image distance and deflection angle, are theoretically formulated. The functions are in good agreement with the results of experiments. In the case of electron beam instruments, the image of the deflected electron beam that passes through the whole part of the deflector becomes a real star pattern caused by the field coma aberration, while, in the case of electron reflection microscopes, the caustic pattern produced by the convergent beam varies from a real star to a star-like pattern caused by the axial coma and astigmatism. (auth)

8926 SPUTTERING OF METALS BY HYDROGEN IONS. C. E. KenKnight and G. K. Wehner (Litton Industries, Minneapolis). J. Appl. Phys., 35: 322-6(Feb. 1964).

Sputtering-yield data for metals are obtained by drilling

holes in thin target foils with magnetically separated, dense hydrogen beams. Results for H_2^+ and H_3^+ at 7 kev are presented for Be, Al, Ti, V, Fe, Co, Ni, Cu, Zr, Mo, Pd, Ag, Ta, W, Re, Ir, Pt, and Au. Results for protons can be inferred from those for molecular ions since the hydrogen atoms sputter independently. Typical results at 7 kev in atoms/ion are for 0.032/H_2^+, 0.046/H_3^+, and for Cu 0.025/H^+, 0.065/H_2^+, 0.105/H_3^+. (auth)

8927 INELASTIC SCATTERING OF FAST ELECTRONS BY THIN CRYSTALS. Fuminori Fujimoto (Tokyo Univ.) and Yoshiro Kainuma. J. Phys. Soc. Japan, 18: 1792-1804(Dec. 1963).

A theory of inelastic scattering of fast electrons by thin crystals is developed. The inelastic scattering exciting plasma oscillation, exciting or quenching thermal vibration, or causing band transition is an application of the theory. (auth)

8928 INTERPRETATION OF EXPERIMENTAL MÖSSBAUER SPECTRUM AREAS. G. Lang (Carnegie Inst. of Tech., Pittsburgh). Nucl. Instr. Methods, 24: 425-8(Nov. 1963).

A previous method for interpreting Mössbauer spectrum areas is reformulated and extended to more general line shapes. The treatment is independent of source line shape and may be applied to multiple line absorbers, provided that the contribution to the spectrum of a given absorber line is distinct. (auth)

8929 DEPOSITION BY ELECTRON BOMBARDMENT AND WEIGHING UNDER VACUUM OF THIN HIGH PURITY BORON LAYERS. J. Van Audenhove, H. L. Eschbach, and H. Moret (Euratom, Geel, Belg.). Nucl. Instr. Methods, 24: 465-70(Nov. 1963).

The equipment and techniques for the deposition of very uniform thin boron layers on aluminum or quartz substrates by electron beam evaporation are described. The performance of a specially designed vacuum micro-balance is reported. (R.E.U.)

8930 FILMS OF SEPARATED ISOTOPES BY VACUUM EVAPORATION. P. N. Trehan (Panjab Univ., India and Bartol Research Foundation, Swarthmore, Penna.). Nucl. Instr. Methods, 24: 471-2(Nov. 1963).

A method for preparing films of separated isotopes of Ni, Cr, and Mo, by vacuum evaporation, is discussed. It was possible to prepare films of thickness varying from few $\mu g/cm^2$ to few mg/cm^2 on gold or platinum backing. (auth)

8931 KINETIC MODEL FOR GASES WITH INTERNAL DEGREES OF FREEDOM. T. F. Morse (Aeronautical Research Associates of Princeton, Princeton, N. J.). Phys. Fluids, 7: 159-69(Feb. 1964).

A new model equation is obtained that permits a kinetic description of gases possessing internal degrees of freedom. The collision term of the model equation is related to the Wang-Chang and Uhlenbeck results for polyatomic gases much in the same manner as the Bhatnagar, Gross, and Krook model is related to the Boltzmann collision integral. A modified perturbation technique utilizing the various time scales of the flow situation was employed in closing the equations of change. (This is shown to be asymptotically equivalent to the Chapman–Enskog expansion of the time derivative.) From the model equation and its moments, depending upon the ratio of a "flow through" time to the inelastic relaxation time, either the bulk viscosity is obtained as a term modifying the pressure tensor, or a relaxation equation for the internal temperature. The model also accounts for the contribution to the heat transfer vector due to the presence of internal degrees of freedom. In this theory, the inelastic relaxation time appears as a parameter of the system. It is hoped that this model may serve the same function for aerodynamic and kinetic boundary value problems for gases with internal degrees of freedom that the Bhatnagar, Gross, and Krook model has for the simple gas. (auth)

8932 BOLTZMANN EQUATION FOR HARD SPHERES IN DIFFERENTIAL FORM. Murray Wachman (General Electric Co., Valley Forge, Penna.). Phys. Fluids, 7: 170-3(Feb. 1964).

It is shown that it is possible to recast the Boltzmann integro-differential equation for hard spheres into a pair of linear partial differential equations of first and eighth orders, respectively. The eighth order equation is shown to be the non-dimensional Laplacian four times repeated. The first order equation is the familiar df/dt with a different forcing function on the right hand side. (auth)

8933 COMPOSITION DEPENDENCE OF GASEOUS THERMAL DIFFUSION FACTORS AND MUTUAL DIFFUSION COEFFICIENTS. E. A. Mason, S. Weissman, and R. P. Wendt (Univ. of Maryland, College Park). Phys. Fluids, 7: 174-9(Feb. 1964). (IMP-AEC-26)

Radioactive tracers are used to measure thermal diffusion factors and mutual diffusion coefficients for several binary gas systems in which one component is present in trace concentration only. The systems are H_2-Ar^{37}, T_2-Ar, T_2-CO_2, and T_2-N_2. These measurements are combined with previous tracer measurements and with earlier measurements on less dilute mixtures to test, over the complete composition range, the theoretical prediction that the reciprocal of the thermal diffusion factor is linear in the mole fraction. The linear relation is found to hold within experimental error. The kinetic theory expressions for the composition dependence are also linear, but do not reliably reproduce the experimental measurements. The implications of these results for the problem of determining intermolecular forces from thermal diffusion measurements are briefly discussed. It is shown that an analogous procedure can be carried out for the composition dependence of the diffusion coefficient, and a new formula for this quantity is derived. This formula can be used to estimate the composition dependence of the diffusion coefficient from measurements of the thermal diffusion factor. This result is checked experimentally. (auth)

8934 POTENTIAL DISTRIBUTION METHOD IN EQUILIBRIUM STATISTICAL MECHANICS. J. L. Jackson and L. S. Klein (National Bureau of Standards, Washington, D. C.). Phys. Fluids, 7: 228-31(Feb. 1964).

A general statistical mechanical relation between the chemical potential and the probability distribution function of the micropotential in a fluid at equilibrium is derived. It is applied to a plasma and a hard-sphere gas. (auth)

8935 THE DETECTION OF THE INELASTIC SCATTERING OF GAMMA RAYS AT CRYSTAL DIFFRACTION MAXIMA USING THE MÖSSBAUER EFFECT. D. A. O'Connor and N. M. Butt (Univ. of Birmingham, Eng.). Phys. Letters, 7: 233-5(Dec. 1, 1963).

The Mössbauer effect is used to distinguish the elastically and inelastically scattered components at Bragg diffraction peaks of x rays from single crystals of lithium fluoride. The proportion of gamma rays emitted without recoil by a Mössbauer source is found by observing their resonant absorption. The Mössbauer source was 10 mC of Co^{57} diffused in metallic iron-56. The resonant absorber was a metallic iron foil of 80% Fe^{57}. (R.E.U.)

8936 AN 'AETHER DRIFT' EXPERIMENT BASED ON THE MÖSSBAUER EFFECT. D. C. Champeney, G. R. Isaak, and A. M. Khan (Univ. of Birmingham, Eng.). Phys. Letters, 7: 241-3(Dec. 1, 1963).

An apparent frequency shift between a gamma source and a resonant absorber attached to opposite tips of a high-speed rotor was searched for. The measurements, interpreted on the classical assumption of an ether drift, place a limit on any steady drift past the earth, resolved parallel to the equatorial plane, of 1.6 ± 2.8 m/sec. (R.E.U.)

8937 GENERALIZED ENTROPY PRODUCTION AND HYDRODYNAMIC STABILITY. P. Glansdorff and I. Prigogine (Université Libre, Brussels). Phys. Letters, 7: 243-4(Dec. 1, 1963).

A generalized from of an evolution criterion for macroscopic systems with time-independent boundary conditions is given. It includes mechanical processes, such as convection, as well as the components of the entropy production. The variational method is tested in the stability of a horizontal layer of fluid at rest and heated from below. The perturbations of the velocity and temperature are considered. (R.E.U.)

8938 SPIN RELAXATION OF OPTICALLY PUMPED CESIUM. F. A. Franz and E. Luescher (Univ. of Illinois, Urbana). Phys. Letters, 7: 277-8(Dec. 1, 1963).

The relaxation time of optically pumped cesium was measured as a function of molecular nitrogen buffer gas pressure. The procedure and results are given. (R.E.U.)

8939 NOTE ON THE 4-BODY SYSTEM. T. Stovall and M. Danos (National Bureau of Standards, Washington, D. C.). Phys. Letters, 7: 278-81(Dec. 1, 1963).

A model is considered in which the 4-body problem of the He^4 nucleus is replaced by a one-body problem in which one nucleon moves in a potential that represents all the other energies and the interactions of the particle with the other three particles. It is found that a $T = 0$ excited state in He^4 can be accommodated by reasonable variables while a $T = 1$ state cannot. The NBS IBM-7094 was used to find a set of parameters that would reproduce the binding energy and rms radius. (R.E.U.)

8940 THEORY OF TRANSPORT IN MODERATELY DENSE GASES. J. A. McLennan, Jr. (Lehigh Univ., Bethlehem, Penna.). Phys. Letters, 7: 332-5(Dec. 15, 1963).

Calculations of the contributions of the intermolecular potential to the microscopic stress tensor, T_{ij}, in the correlation-function expression for shear viscosity, in transport theory, are made. An expression for the viscosity of a gas of classical hard spheres is derived. (L.B.S.)

8941 SPACE POWER SYSTEMS. George C. Szego (Inst. for Defense Analyses, Washington, D. C.). Proc. Am. Power Conf., 25: 45-82(1963).

A review is presented of power systems for the navigation of space. The power system is divided into three parts (energy source, conversion system, and waste-heat rejection system), and each is discussed in some detail. The problem of meteorite damage is considered. Specific power sources are discussed: radioisotope, nuclear, solar energy conversion, fuel cells chemical rotating systems, and static thermal energy conversion. Comparisons are made of the performance of competitive systems. (D.L.C.)

8942 SIMPLE TECHNIQUE FOR EXAMINATION OF SPUTTERING PATTERNS. Ronald E. Nielsen and William B. Shepherd (Univ. of Minnesota, Minneapolis). Rev. Sci. Instr., 35: 123-4(Jan. 1964).

A method involving the strong interference colors from Ta_2O_5 on Ta was developed for determining the effects of sputtering geometry and operating parameters on the areal uniformity of the sputtering of anodized Ta samples. (R.E.U.)

8943 ENERGY LOSSES BY FAST ELECTRONS IN THIN SOLID FOILS. Hideo Kanazawa (Tokyo Univ.). Sci. Papers Coll. Gen. Educ., Univ. Tokyo, 13: 171-7 (Dec. 1963).

A formula was derived for the energy loss rate of fast electrons passing through thin solid foils and it is shown that the energy loss rate has two peaks corresponding to the excitations of normal and tangential plasmons. The Green function method, which is similar to the self-energy approach, was used. Experimental results for Ge and Si are tabulated. (P.C.H.)

8944 TWO-DIMENSIONAL PROBLEM ON CURRENT DISTRIBUTION IN ELECTRIC CONDUCTING MEDIA MOVING ALONG A CHANNEL IN A MAGNETIC FIELD. A. B. Vatazhin. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 2, 39-54 (Mar.-Apr. 1963). (In Russian)

The problem of current distribution in a channel with dielectric walls, arbitrary velocity profile and conductivity, and a magnetic field that is an arbitrary function of longitudinal coordinates was resolved. A two-dimensional problem in which the current distribution has two regions (one side of the wall is a dielectric and the other is a long electrode) was analyzed considering the magnetic field and electric conductivity to be constant and the electric conductivity to differ from zero only in an electrode zone. (R.V.J.)

8945 PROPAGATION OF AN INITIAL PULSE WITH ARBITRARY CONDUCTIVITY IN MAGNETOHYDRODYNAMICS. G. S. Golitsyn. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 2, 55-62(Mar.-Apr. 1963). (In Russian)

Propagation of weak perturbations in a medium with arbitrary conductivity in a magnetic field was analyzed. Investigations of asymptotic behavior for large time magnitudes indicate that the perturbation transforms into a series of single waves. An arbitrary conducting medium with a set of waves with various lengths, (wave package) each propagating at a given velocity and subject to dampening, was investigated. (R.V.J.)

8946 IMPLICIT AND FORMAL USES OF A FLAT METRIC IN GENERAL RELATIVITY. Gerald Howard Katzin. Thesis, Raleigh, N. C., North Carolina State Coll., 1963. 186p.

The meaning of functions of the Riemannian coordinates and their relation to measurements are investigated. It is shown how symmetries of a Riemannian space-time describable by groups of motions may be given physical interpretation in terms of flat space-time concepts. The linear first integrals of the differential equations of motion of a test particle in a curved space-time are interpreted in terms of flat space-time counterparts. Analysis of the symmetries admitted by the Friedmann-Lemaître space-time for an open cosmological model shows that they have the same structure as the homogeneous Lorentz group of a flat space-time expressed in a properly chosen coordinate system, in which the components of the flat metric tensor are functions of time. This relationship is interpreted with respect to possible inertial properties of the cosmological model. Einstein's linearized field theory for weak gravitational fields is analyzed. It is shown how the flat space-time implicit in Einstein's treatment can be given formal recognition in a more general manner. Einstein's linearized weak-field theory is extended so that nearly flat Riemannian space-times can be represented in

terms of deviations from flat space-times expressed in any coordinate system. It is hypothesized that a flat metric can formally be introduced into general relativity as a concomitant second metric, which is interpreted as characterizing an operationally Euclidean observer. The association of a particular flat metric with a particular curved metric is shown to be equivalent to relating the Riemannian observables to the measurements of a particular observer. It is shown that symmetries admitted by the curved space-time aid in the proper matching of curved and flat space-times. Kohler's two metric principle of equivalence and Rosen's variable mass treatment are considered. The formulation of covariant conservation laws for the gravitational field are briefly discussed. (M.P.G.)

8947 A STUDY OF EXACTLY SOLUBLE N BODY PROBLEMS. James Barker McGuire. Thesis, Los Angeles, Univ. of California, 1963. 75p.

It is shown that several cases of one-dimensional n-body problems are exactly soluble. The first case described the motion of 3 one-dimensional particles of arbitrary mass which interact with one another via infinite strength repulsive delta function potentials. It is found that the stationary state solution of the scattering of the 3 particles is analogous to an electromagnetic diffraction problem that has already been solved. The solution to this analogous electromagnetic problem is interpreted in terms of particles. Next it is shown that the problem of 3 particles of equal mass interacting with each other via finite but equal strength delta function potentials is exactly soluble. This example exhibits rearrangement and bound state effects, but no inelastic processes occur. Finally it is shown that the problem of n particles of equal mass all interacting with one another via finite but equal strength delta functions is exactly soluble. Again no inelastic processes occur, but various types of rearrangements and an n-particle bound state do occur. These rearrangements and the n-particle bound state are illustrated by means of a series of sample calculations. (Dissertation Abstr.)

8948 ATLAS OF ELECTRON SPIN RESONANCE SPECTRA. THEORETICALLY CALCULATED MULTICOMPONENT SYMMETRICAL SPECTRA. Ya. S. Lebedev, D. M. Chernikova, N. N. Tikhomirova, and V. V. Voevodskii. Authorized Translation from the Russian. New York, Consultants Bureau Enterprises, Inc., 1963. $15.00.

Some ESR spectral calculations with unresolved hfs are given for various line numbers, intensity distributions, and ratios of component width to splitting on the assumptions that the components are symmetrical and have the same width and splitting. Spectra are given for hfs components from 2 to 6 in number with Gaussian and Lorentzian forms. (R.E.U.)

8949 BROADENING OF BALMER LINES FOR HIGH QUANTUM NUMBER. B. H. Armstrong (Lockheed Missiles and Space Co., Palo Alto, Calif.). 9p. (CONF-364-1)

From 16th Annual Gaseous Electronics Conference, Pittsburgh, Oct. 1963.

It is shown that the impact theory breakdown at sufficiently large distances from the line center in effect lowers the principle quantum number at which electron broadening might otherwise be assumed to dominate. Since the impact theory breaks down and effectively the impact widths decrease progressively for the line components more distant from the center, the contributions of the components to the folding integral decrease rapidly except at their own positions. (R.E.U.)

8950 REACTIVE SPUTTERING. N. Schwartz (Bell Telephone Labs., Inc., Murray Hill, N. J.). 38p. (CONF-209-19)

From American Vacuum Society Meeting, Boston, Oct. 1963.

A summary of recent work on reactive sputtering is presented. Sputtering mechanisms and the behavior of various materials under sputtering conditions are discussed. 32 references. (R.E.U.)

Accelerators

8951 (BNL-7618) RF STRUCTURE OF PROTON LINAC BEAMS. R. L. Gluckstern (Brookhaven National Lab., Upton, N. Y.). Oct. 31, 1963. Contract AT-30-2-GEN-16. 9p.

The properties of the beam at the end of the linear accelerator are given, and consideration of the requirements for injection into the alternating-gradient synchrotron indicates that a beam of 1 to 2×10^{13} protons/pulse with these properties will probably be accepted. The tight r-f bunching seems to pose no problems, but the energy spread should be held to about ±3.5 Mev. Consideration of the suitability of the beam for experiments leads to an examination of the feasibility of some methods of debunching the r-f microstructure. (D.C.W.)

8952 (LAMS-3025) INTRODUCTION TO THE PROPOSED LOS ALAMOS MESON PROJECT. Louis Rosen and D. E. Nagle (Los Alamos Scientific Lab., N. Mex.). Dec. 1963. Contract W-7405-eng-36. 34p.

The desirability of a meson (π) factory is indicated, and the proposed factory using an 800-Mev proton accelerator is briefly described. The beams and fluxes available are summarized, and the utility of the facility for nuclear physics studies is discussed. The presently envisaged experimental program is outlined. The development of linear accelerators is also outlined; and the design, feasibility, and parameters of the 800-Mev accelerator are discussed. Construction costs and time for the facility are considered as well. (D.C.W.)

8953 (MURA-674) A METHOD OF RADIO-FREQUENCY INFLECTION INTO A PARTICLE ACCELERATOR. Donald Scott Roiseland (Midwestern Universities Research Assn., Stoughton, Wis.). June 10, 1963. Contract AT(11-1)-384. 224p.

Thesis submitted to Univ. of Wisconsin, Madison.

A radio-frequency method of inflecting particles (supplied from a given injector) into orbits suitable for subsequent acceleration in a cyclic particle accelerator is studied theoretically and experimentally. The particles circulating in the accelerator are subjected to an r-f bump: a transverse radio-frequency electric field over a small length of the orbit, tuned to the frequency of the radial betatron oscillations. It is shown that, in the absense of nonlinear effects and with no septum (inactive injector extremity), the number of particles made available for acceleration can be as large as the limit set by Liouville's theorem (100% filling efficiency). In achieving this limit not less than 75% of the injected charge is wasted (25% charge efficiency). Nonlinear effects decrease both the charge and filling efficiencies. (auth)

8954 (NIRL/M/34) BEAM-LOADING EFFECTS IN THE ALVAREZ STRUCTURE OF A C. W. PROTON LINEAR ACCELERATOR. Planet Project Report No. 3. A. Carne (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England). July 1962. 11p.

The resistive and reactive loading of a proton beam on a unit Alvarez cell of a c-w linear accelerator are found from small signal theory and equivalent circuit. The maximum phase error for a matched system is given by the simple formula $\tan \psi = \frac{1}{2} \tan \phi_s$, where ϕ_s is the synchronous phase angle. Small beam fluctuations are shown to have little effect in a constant voltage system. (auth)

8955 (SAL-1) SHAPE OF NEUTRON PULSES FROM A NATURAL URANIUM TARGET. D. N. Southam and J. D. King (Saskatchewan. Univ., Saskatoon. Saskatchewan Accelerator Lab.). June 1963. 13p. (CONF-250-1)

From American Physical Society 1963 Summer Meeting in the West, Edmonton, Canada, Aug. 1963.

The shapes of the neutron pulses emerging from targets under bombardment by electron beam pulses of various shapes were investigated as a function of the relaxation time for each assumed source pulse shape. Relaxation times for conical and spherical targets were obtained by Monte Carlo calculations. The results show that the relaxation time due to elastic scattering will limit the minimum useful pulse length obtainable from pure natural uranium targets in an electron beam. Also, the relaxation $\lambda\tau\sqrt{E} \approx$ constant seems to hold for a given target shape and size. (D.C.W.)

8956 (SLAC-19) A BENDING MAGNET WITH NON-SATURATING SHIMMING. B. Hedin (Standford Univ., Calif. Stanford Linear Accelerator Center). Sept. 1963. Contract AT(04-3)-400. 33p.

In a magnet with rectangular poles, the field falls off towards the sides even if the permeability would be infinitely large in the poles. At the sharp corners, the flux density will however be infinitely high such that all materials saturate even at low fields in the gap. This saturation will result in an even more pronounced drop of the field in the gap. By adding iron at the corners and reducing the gap there (a procedure called shimming) the homogeneous region of the field can be enlarged. The theoretical shape of such shims has been calculated by M. E. Rose for infinite permeability. Other calculations have taken the saturation into account for one particular field strength in the gap. To get a field shape that is essentially independent of the field strength in the gap up to a level where the entire poles start to saturate, one must have the shims rounded with sufficient radius to avoid local saturation. The design of such shims to produce a wide region of homogeneous field is calculated. Calculations are given for a 3 degree bending magnet for 25 Bev electrons. (auth)

8957 (SLAC-20) EFFECTS OF STRAY MAGNETIC FIELDS AND RF COUPLER ASYMMETRY IN THE TWO-MILE ACCELERATOR WITH SECTOR FOCUSING. R. H. Helm (Stanford Univ., Calif. Stanford Linear Accelerator Center). Oct. 1963. 24p. Contract AT(04-3)-400.

The tolerances on stray magnetic fields and on coupler asymmetry are calculated for moderate focusing, which corresponds to a low-energy cutoff of 1.4 Bev, and minimal focusing, where there is just enough admittance to transport the initial phase space of the beam. The tolerances obtained are compared with estimates of the magnitudes of various effects (variations of geomagnetic fields, etc.), and measures required to meet the tolerances are indicated. (D.C.W.)

8958 (SLAC-23) TWO-MILE ACCELERATOR PROJECT. Quarterly Status Report, July 1 to September 30, 1963. (Stanford Univ., Calif. Stanford Linear Accelerator Center). Oct. 1963. Contract AT(04-3)-400. 85p.

The development of accelerator structures, klystrons, electronic equipment, microwave equipment, vacuum systems, magnets, and beam equipment is summarized, together with development and operation of the Mark IV accelerator and experimental physics research. (D.C.W.)

8959 (TID-19940) ANNUAL PROGRESS REPORT [ON LINEAR ACCELERATOR], DECEMBER 1962–NOVEMBER 1963. (Minnesota. Univ., Minneapolis. Linear Accelerator Lab.). Nov. 1963. Contract AT(11-1)-50. 161p.

Separate abstracts were prepared for four sections on accelerator progress, experimental instrumentation, and the experimental and theoretical programs. (D.C.W.)

For abstracts of individual sections see: 8649, 8920, 8960, and 9319.

8960 (TID-19940(p.1-21)) ACCELERATOR PROGRESS. (Minnesota. Univ., Minneapolis. Linear Accelerator Lab.).

The performance and improvement of the accelerator are discussed, along with developments in equipment and techniques. Changes in the vacuum systems and testing of a 60° sector magnet were among the developments. Construction of the 500-kev d-c injector proceeded. (D.C.W.)

8961 THERMAL VELOCITY LIMIT TO CURRENT DENSITY IN A BEAM. A. J. Lichtenberg (Univ. of California, Berkeley). J. Appl. Phys., 35: 315-19(Feb. 1964).

The limiting current density that can be achieved with thermal velocities in the source emission is calculated by phase-space ellipse transformations. The results check those of Pierce, and are applicable to a wider range of problems. Simple lens systems can realize the ellipse transformations that give the limiting density. Under certain conditions the maximum current density is obtained between the object plane and the image plane, a situation analogous to the waist formation in a beam transport system used with particle accelerators. (auth)

8962 HIGH-ENERGY ACCELERATORS FOR NUCLEAR-PHYSICS RESEARCH. J. B. Adams. J. Inst. Elec. Engrs. (London), 9: 251-2(June 1963).

A brief review of the development and methods of focusing are given for cyclotrons, synchrotrons, synchrocyclotrons, and linear accelerators. (C.E.S.)

8963 DESIGN CRITERIA FOR A 700 Mev CYCLOTRON TO ACCELERATE NEGATIVE HYDROGEN IONS. J. Reginald Richardson (Univ. of California, Los Angeles). Nucl. Instr. Methods, 24: 493-500(Nov. 1963).

A spiral ridge design is suggested that would result in negligible loss of the beam. This design employs a hill of 5000 gauss and a mean field of 4300 gauss. The resulting magnet is very large, being 70 feet in diameter, but it is by no means out of the question. The virtues of the system include complete extraction, variable energy, multiple simultaneous beams extracted at differing energies, and a new method is proposed where, by means of a phase sampling system, almost 100 per cent duty factor can be achieved. (auth)

8964 CONTRIBUTION TO IMPROVEMENT OF FOCALIZATION IN MICROTRON. F. Porreca (Università, Naples). Nuovo Cimento (10), 30: 700-10(Nov. 1, 1963). (In Italian)

A remarkable intensity increase of the electron beam accelerated in a microtron was carried out by means of the magnetic field of a magnetic shell suitably directed around the accelerating cavity. The order of magnitude of the focalizing field is about (1 to 0.5)% of the uniform field

intensity of the machine. The effect is explained by taking account of the periodicity of the axial and radial forces generated by the additional field on the electron beam. The effect is the first attempt to furnish the microtron with a focalizing device that acts along all the distribution of orbits followed by the electrons. (auth)

8965 THE CERN SEPARATED LOW-MOMENTUM ANTIPROTON BEAM. U. Amaldi, Jr., T. Fazzini, G. Fidecaro, C. Ghesquière, M. Legros, and H. Steiner (CERN, Geneva). Nuovo Cimento (10), 30: 973-96 (Nov. 16, 1963).

The layout of a beam transport system for antiprotons, operating up to a maximum momentum of about 4 Bev/c is described. Electrostatic separators were used for the separation of antiprotons from pions up to about 1 Bev/c. Separation at higher momenta was obtained by means of time-of-flight. Results are given concerning fluxes of pions and antiprotons, and excitation curves for production of antiprotons. (auth)

8966 INJECTION OF INTENSE NEUTRAL BEAMS INTO A TANDEM ACCELERATOR. A. B. Wittkower, P. H. Rose, R. P. Bastide, and N. B. Brooks (High Voltage Engineering Corp., Burlington, Mass.). Rev. Sci. Instr., 35: 1-11(Jan. 1964).

A single-stage tandem accelerator, which utilizes the principle of neutral-beam injection, is described. Ten microamperes of high-energy negative hydrogen ions were obtained. These ions may be injected into a second two-stage tandem accelerator, thus obtaining higher energies for nuclear studies. By reversing the polarity of the injector terminal, positive hydrogen ion currents in the 100-μA range were obtained. (auth)

8967 SELECTION AND PRIMARY FOCUSING OF IONS IN A MULTICHARGED ION SOURCE. F. I. Mineev and O. F. Kovpik. Zh. Tekhn. Fiz., 33: 1444-8(Dec. 1963). (In Russian)

Efficient use of plasma focusing in the selection of ions from a multi-charged nitrogen-filled pulsed ion source was investigated. A pulsed heavy ion current of 3 μa at 35 kv was obtained with optimum discharge parameters. Half the current consisted of nitrogen ions, the rest was source materials. Currents of N_{14}^{3+}, N_{14}^{4+}, and F_{19}^{3+} indicate the feasibility of using the proposed multicharged ion source with plasma focusing in linear accelerator injectors. (R.V.J.)

8968 CALCULATIONS FOR A BUNCHER FOR A TRAVELLING WAVE LINEAR ACCELERATOR BY A GIVEN LAW OF GROUPING. G. I. Zhileiko. Zh. Tekhn. Fiz., 33: 1449-61(Dec. 1963). (In Russian)

Formulas for determining for the case of small deflection from equilibrium, electron bunching parameters, were developed on the basis of variations in cluster length and electron energy deviation from equilibrium. The obtained equations consider space charge forces and may be used in determining maximum beam parameters. (tr-auth)

8969 OPTICAL SPECTROSCOPY WITH VAN de GRAAFF ACCELERATORS. Stanley Bashkin (Univ. of Arizona, Tucson). 34p. (CONF-354-3)

From Accelerator Conference, Boston, Nov. 1963.

The applications and advantages of Van de Graaff accelerators in spectroscopy are discussed. Some typical results of ionization potentials, level positions, level structures, charge states, and energy of ions are given. 26 references. (R.E.U.)

8970 GENERATION AND ACCELERATION OF POSITRONS, USING THE UNIVERSITY OF SASKATCHEWAN LINEAR ELECTRON ACCELERATOR. D. E. Lobb and L. Katz (Univ. of Saskatchewan, Saskatoon). 6p. (CONF-250-15)

From American Physical Society, 1963 Summer Meeting, Edmonton, Can., Aug. 1963.

Electrons accelerated to 20 Mev in the first accelerator section fall on a thick target, producing positrons by pair production. The succeeding three linac sections are used to accelerate the positrons. A peak electron current of 0.3 amp from the first section produces a useful peak positron current of 0.1 mamp (a useful conversion efficiency of 3×10^{-4} positron/electron), which means a time-average positron current of 0.1 μamp. With injection of the positrons into the second linac section at optimum phase with respect to the traveling wave, the output-positron beam is expected to have energies up to 115 Mev with an energy spread of ±1.5 Mev. (auth)

8971 METHOD FOR THE MEASUREMENT OF THE VARIATION OF THE INTENSITY IN TIME OF THE BEAM OF AN ACCELERATOR, e.g., CYCLOTRON WHICH CONSISTS OF ELECTRICALLY CHARGED FAST PARTICLES. Hans-Helmut Feldmann (to Licentia Patent-Verwaltungs GmbH). German Patent 1,153,470. Aug. 29, 1963. Filed July 20, 1961.

The method described comprises arranging a delay line along the particle beam and of decoupling energy from the electromagnetic field generated by the beam. The wave velocity of the delay line is chosen equal to the velocity of the particles. (Gmelin Inst.)

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Refer also to abstracts 8267 and 9526.

8972 (NP-13493) BERICHTE AUS DER METEORITENFORSCHUNG. NO. 58. STRAHLUNGSALTER EINIGER EISENMETEORITE. (Report on Meteorite Research. No. 58. Radiation Age of an Iron Meteorite). H. Voshage and D. C. Hess (Max-Planck-Institut fur Chemie, Mainz). [1963]. 14p.

The cosmic-ray exposure ages of eight iron meteorites have been determined using the K^{40}/K^{41} method. The results are: Canyon Diablo 655 ± 65 Myr, Dayton 215 ± 85 Myr, Grant 695 ± 55 Myr, Morradal 155 ± 95 Myr, Norfolk 680 ± 55 Myr, Norfolk 605 ± 75 Myr, Pinon 695 ± 125 Myr, Washington County 610 ± 70 Myr. (auth)

8973 (NP-13494) BERICHTE AUS DER METEORITENFORSCHUNG. NO. 54. HELIUM- UND NEONISOTOPE IN EISENMETEORITEN. (Report on Meteorite Research. No. 54. Helium and Neon Isotopes in Iron Meteorites). H. Hintenberger and H. Waenke (Max-Planck-Institut fur Chemie, Mainz). [1963]. 23p.

The helium and neon content of 22 iron meteorites as well as the isotopic composition of the rare gases have been measured. Definite relations were found between the amounts of the cosmic ray-produced isotopes He^3, He^4, and Ne^{21} and also for their ratios. A rough correlation between the mass of the meteorite and the "depth" of the sample has been found; a correlation for the He^3/He^4 and the He^4/Ne^{21} ratios also exists. The following relationship holds for 19 of the 21 meteorites: $He^3/He^4 = 0.166 + 174\ (\Sigma Ne/\Sigma He) \pm 0.018$. The only exceptions are the meteorites Braunau and Colomera. Because these exceptions only show up in diagrams in which the values for He^3 are included, it is assumed that both these meteorites, as well as perhaps also the meteorite Morradal, have lost part of their He^3. This might be explained by a diffusive loss of tritium dur-

ing times of higher temperatures of the meteoritic bodies, probably due to a closer approach of these meteorites to the sun. (auth)

8974 (NP-13495) BERICHTE AUS DER METEORITENFORSCHUNG. NO. 55. RADIOGENE, SPALLOGENE UND PRIMORDIALE EDELGASE IN STEINMETEORITEN. (Report on Meteorite Research. No. 55. Radiogenic, Spallogenic, and Primordial Rare Gases in Stone Meteorites). H. Hintenberger, H. Koenig, L. Schultz, and H. Waenke (Max-Planck-Institut fur Chemie, Mainz). [1963]. 37p.

The total content as well as the isotopic composition of helium and neon of 47 stone meteorites have been determined. The concentrations of He^3, He^4, Ne^{20}, Ne^{21}, and Ne^{22} are included in the tables. For meteorite samples without primordial rare gas content, the radiogenic component of He^4 has been calculated by subtracting the fourfold amount of He^3 from the total He^4 in order to allow for the spallation fraction of He^4. From radiogenic He^4, the U–Th–He ages of the investigated meteorites have been calculated using an average uranium content of $1.1 \cdot 10^{-6}$ g/g and the 3.5 fold amount for thorium, except those cases where uranium determinations already existed. The cosmic ray exposure ages were calculated using the average production rates for He^3 and Ne^{21} derived from the decay rate of tritium and Na^{22} measured in some meteorites. The calculated values for the exposure ages lay between $0.5 \cdot 10^6$ years and $40 \cdot 10^6$ years. Some of the meteorites showed very low He^3/Ne^{21} ratios which indicate diffusion loss of the spallogenic rare gases. From the large number of the measurements, the results indicate differences in the distribution of the U–Th–He ages as well as for the cosmic ray exposure ages between these chondrites of the low iron group (L) and the chondrites of the high iron group (H). On the average the U–Th–He ages of the H group chondrites are considerably higher than those of the L group. In fact, there are only a few H group chondrites with the low U–Th–He ages, and for most of these exceptions it is shown that they lost their radiogenic He^4 during the time of cosmic ray exposure. The cosmic ray exposure ages of the H group chondrites are below 10 million years in 74% of the cases, while for those of the L group only 40% are below this value. Investigations on the 47 meteorites also disclosed two additional meteorites (Pultusk and Vigarano) which exhibit a high content of light primordial rare gases, as was earlier found for Pantar, Breitscheid, and Tabor. (auth)

8975 (NP-13496) BERICHTE AUS DER METEORITENFORSCHUNG. NO. 56. ZUR FRAGE DER DIFFUSIONSVERLUSTE VON RADIOGENEN UND SPALLOGENEN EDELGASEN AUS STEINMETEORITEN. (Report on Meteorite Research. No. 56. The Question of Diffusion Loss of Radiogenic and Spallogenic Rare Gases From Stone Meteorites). H. Hintenberger, E. Vilcsek, and H. Waenke (Max-Planck-Institut fur Chemie, Mainz). [1963]. 17p.

Using a newly developed technique of specific solvents, the rare gas contents of the main mineral fractions of stone meteorites were measured separately. In this way, the diffusion loss of the radiogenic and spallogenic rare gases in 5 chondrites which all had U–Th–He ages considerably below 4.5 billion years was studied. The results showed that in 4 of these meteorites, which all belong to the Urey-Craig group L, no diffusion losses occurred during the time of cosmic ray exposure. Only in one of the meteorites, i.e., Breitscheid, (group II) large diffusion losses of the cosmic ray produced He^3 were found. Considerable losses of radiogenic He^4 could be proved for the meteorites Breitscheid and Bruderheim. For the meteorite Breitscheid the loss of He^4 seems to be approximately a factor of 2 lower than that of He^3. This last result seems, for the first time, to give an indication of an early cosmic ray exposure of meteoritic matter, long before the meteorites, as small objects, were broken off from their big parent body. (auth)

8976 (NP-13497) BERICHTE AUS DER METEORITENFORSCHUNG. NO. 57. DIE RELATIVEN PRODUKTIONSQUERSCHNITTE FUR ^{3}He UND ^{21}Ne AUS Mg, Si, S UND Fe IN STEINMETEORITEN. (Report on Meteorite Research. No. 57. The Relative Production Cross Sections for He^3 and Ne^{21} From Mg, Si, S, and Fe in Stone Meteorites). H. Hintenberger, H. Koenig, L. Schultz, H. Waenke, and F. Wlotzka (Max-Planck-Institut fur Chemie, Mainz). [1963]. 16p.

With various mineral separation methods, including the newly developed technique of specific solvents, very pure fractions of metallic iron, troilite, olivine, and pyroxene were separated from the Holbrook meteorite. Helium and neon were extracted from those minerals. The measurements allowed a determination of the relative production rates of He^3 and the neon isotopes by cosmic rays in iron, sulfur, magnesium, and silicon. The results enable the calculation of the relative production rates of these isotopes in all kinds of meteorites whatever their chemical composition. The ratio of the relative production rates of Ne^{21} from Mg and Si is 1.8 ± 0.4. Therefore, it can be concluded that the variations of the He^3/Ne^{21} ratio in stone meteorites can not be explained by variations in their chemical composition, at least not for the normal chondrites. (auth)

8977 SOLAR BURSTS. J. P. Wild, S. F. Smerd, and A. A. Weiss (CSIRO, Sydney). Ann. Rev. Astron. Astrophys., 1: 291-366(1963).

Observations, interpretations, and associations of solar radio bursts are presented to obtain a consistent physical picture of solar flare events. The recognized types of bursts, their observed features, and some interpretations are discussed. The flare is considered as a complete event, and it is shown how the complex sequence of radio bursts that accompany large events helps to give an integrated picture of the widespread manifestations of flares. The theoretical aspects are explored, and a review is given of current ideas on the generation and propagation of radio waves in a plasma. The prominent problems and techniques of the next solar cycle are discussed. 158 references. (R.E.U.)

8978 SOLAR SPECTROSCOPY. Leo Goldberg (Harvard Univ., Cambridge, Mass.). J. Quant. Spectry. Radiative Transfer, 3: 519-28(Oct.-Dec. 1963).

The spectrum of the chromosphere and the visible solar spectrum are discussed. (P.C.H.)

8979 SOME SPECTROSCOPIC PROBLEMS OF THE INTERSTELLAR MEDIUM. G. H. Herbig (Univ. of California, Mt. Hamilton). J. Quant. Spectry. Radiative Transfer, 3: 529-36(Oct.-Dec. 1963).

The current status of important spectroscopic open-ended problems as illustrations of what has been accomplished and what is now being done in interstellar research from the ground is discussed. Special consideration is given to the origin of molecules in space, the diffuse interstellar bands, and light elements in the interstellar medium. The problem of the light elements (Li, Be, and B) in interstellar space shows how earthbound and extraterrestrial observations supplement one another. The need for new data is emphasized. (P.C.H.)

8980 THE COSMOLOGICAL PROBLEM. Allan Sandage (Carnegie Institution of Washington, D. C. and California Inst. of Tech., Pasadena). J. Quant. Spectry. Radiative Transfer, 3: 541-9(Oct.-Dec. 1963).

The determination of the general metric of an idealized universe is discussed. (P.C.H.)

8981 THE STRUCTURE OF SUNSPOTS. S. M. Chitre (Church Hill Coll., Cambridge, Eng.). Monthly Notices Roy. Astron. Soc., 126: 431-43(1963).

An investigation is made into the structure of the umbra of a single circular spot that is in quasi-static equilibrium. The coolness of the spot surface is supposed due to the magnetic field, which both cuts down the efficiency of convective transport of energy and at the same time reduces the surface flux by channeling the convection parallel to the field. The center of the spot surface is found to lie about 500 km below the normal surface. A consistent umbral model can be produced in which, as the ratio of the magnetic to the thermal energy density decreases with depth, the temperature and the density in the spot approach the corresponding physical values in the undisturbed layers at the same depth; the flux increases to the normal solar value; and the reduction in the efficiency of convection vanishes. (auth)

8982 THE SOLAR CORONA IN INTERPLANETARY SPACE. A. Hewish and J. D. Wyndham. Monthly Notices Roy Astron. Soc., 126: 469-87(1963).

An account is given of further observations of the outer corona made during 1960, 1961, and 1962. The radio scattering technique was used, and by comparing measurements on the Crab Nebula and 3C 123 it is shown that the scattering corona is considerably flattened towards the equatorial plane. New arguments are discussed that indicate that the coronal filaments have diameters smaller than 5,000 km at 60 $R_\odot$; when extrapolated to the solar surface these dimensions are comparable to the scale of chromospheric spicules. An analysis of the observed radial variation of scattering was made and it is shown that the observations are consistent with a rapid solar wind provided that the flow lines converge slightly toward the equatorial plane. Consideration is given to the electron density that is necessary to account for the observed scattering phenomena. (auth)

8983 DEFICIENCY OF METALS IN POPULATION II STARS. George Wallerstein (Univ. of California, Berkeley) and E. Margaret Burbidge. Nature, 200: 1081-2(Dec. 14, 1963).

An attempt is made to explain the deficiency of heavy elements in Population II halo stars on the basis of processes of nucleosynthesis and stellar evolution. Data are presented on the abundances of various elements, relative to the sun, representative of different ionization potentials in two metal-poor red giant stars. (C.H.)

8984 THE ABUNDANCE OF THE TWO NEUTRINOS IN THE UNIVERSE. G. Marx (Roland Eötvös Univ., Budapest). Nuovo Cimento (10), 30: 1555-9(Dec. 16, 1963).

An attempt is made to estimate the abundance of the electron- and meson(μ)-associated neutrinos in the universe. Expressions are presented for the integral mass density and thermal distribution. Probable reactions in which the neutrinos are produced are discussed. It is concluded that an empirical determination of the overall densities of the different neutrinos is possible in principle, the best method being seemingly given by tritium and meson(μ) decay. (C.E.S.)

8985 GRAVITATIONAL LENSES. Sidney Liebes, Jr. (Princeton Univ., N. J.). Phys. Rev., 133: B835-44 (Feb. 10, 1964).

A stellar gravitational lens has the capacity to intensify by a factor in excess of 1,000 the image of another star suitably aligned behind it. This capability, reported in 1936 by A. Einstein in response to a suggestion by R. W. Mandl, appears today not to be generally well known. The imaging properties of the gravitational lens are discussed, and mechanisms whereby lens effects might manifest themselves are evaluated. The relative proper motions of the stars in our galaxy will occasionally give rise to transitory alignments producing time symmetric pulses of light intensity. Typically, for two stars aligned to better than $\sim 10^{-6}$ rad, the image configuration of the more distant, object star will be characterized by an intensification varying inversely with the angular separation of the stars. This inverse angular dependence persists until the disk of the object star, subtending perhaps $\sim 10^{-11}$ rad, passes behind the center of the deflector star. It is estimated, for events involving the $\sim 10^9$ observable stars of the Milky Way, that $\tau_I / A_M \approx 3 \times 10^6$ sec, and $\tau_W A_M \approx 5 \times 10^7$ sec, where τ_I represents the mean interval between all events that will exhibit at closest alignment an intensity gain for the object star in excess of A_M, and τ_W denotes the temporal width of that pulse characterized by A_M. For the case of a globular cluster of $\sim 3 \times 10^5$ deflector stars moving between the earth and the relatively dense object stellar population in the direction of the galactic center, it is found that $\tau_I / A_M \approx 3 \times 10^8$ sec, and $\tau_W A_M \approx 7 \times 10^6$ sec. For events involving stars entirely within a single globular cluster of $\sim 10^6$ stars, it is found that $\tau_I / A_M \approx 8 \times 10^7$ sec, and $\tau_W A_M \approx 3 \times 10^6$ sec, with A_M restricted, in this case, to be less than ~60. Unaccounted for white dwarf and neutron deflector stars are not likely to contribute more than a factor of ~2 increase in the frequency of events. No planets of the sun are useful for producing image intensifications. As a result of their gravitational lens action upon the light from other stars, all stars are surrounded by radial spikes of concentrated light intensity. Such spikes might occasionally manifest themselves as luminous beams in cosmic dust or gas clouds. A statistical analysis of the images of distant galaxies might reveal spectral anomalies explicable in terms of red shifted object galaxies intensified by the lens action of nearer deflector galaxies. (auth)

8986 ELECTROMAGNETIC FIELDS IN A HOMOGENEOUS, NONISOTROPIC UNIVERSE. Dieter R. Brill (Yale Univ., New Haven). Phys. Rev., 133: B845-?(Feb. 10, 1964).

A solution of the Einstein-Maxwell equations is derived that represents a closed universe of topology $S^3 \times R$, filled with gravitational and electromagnetic radiation. The lowest of the large number of possible modes of radiation in such a universe is considered. This mode has maximum symmetry consistent with the existence of a vector field; the universe is homogeneous but not isotropic, and is therefore a generalization of one of the solutions discussed by Taub. It is possible to solve explicitly for the metric coefficients. Some of the physical properties of the solution are discussed. (auth)

8987 FURTHER EVIDENCE FOR THE EXISTENCE OF GALACTIC X RAYS. Herbert Gursky (American Science and Engineering, Inc., Cambridge, Mass.), Riccardo Giacconi, Frank R. Paolini, and Bruno B. Rossi. Phys. Rev. Letters, 11: 530-5(Dec. 15, 1963).

Geiger counter and scintillation detection systems (described) were carried aloft by rockets in June 1963 and October 1962. Analysis of the data indicates the existence of a main source of x radiation near the center of the galaxy and of two secondary sources. (D.C.W.)

8988 NONCONSERVATION OF ENERGY DURING COSMIC EVOLUTION. Jaroslav Pachner (Technical Univ., Prague). Phys. Rev. Letters, 12: 117-18(Jan. 27, 1964).

A method is proposed for a quantitative examination of the question of whether the observed high angular momenta of galaxies and other related phenomena are a consequence of the nonconservation of energy during cosmic evolution. The treatment is nonrelativistic because there exists no uncertainty in classical analytical dynamics as to how to define the total energy of a particle. (C.E.S.)

8989 GRAVITATIONAL COLLAPSE. Peter G. Bergmann (Yeshiva Univ., New York). Phys. Rev. Letters, 12: 139-40(Feb. 3, 1964).

The metric and topological conditions prevailing at or about the Schwarzschild radius in the gravitational collapse of quasistellar objects are examined independent of spherical symmetry. (C.E.S.)

8990 EVOLUTION OF THE STARS. Chushiro Hayashi, Rēun Hōshi, and Daiichiro Sugimoto (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), Suppl., No. 22, 1-183(1962).

Modern theories on the evolution of stars are extended to the phases of helium burning, carbon burning, and later burnings as far as possible, and the theoretical results are compared with the Hertzsprung-Russell diagrams of star clusters. The topics discussed include nuclear energy generation and energy loss by neutrinos, quasi-static equilibrium, envelope,core, and surface solutions, stellar models with homogeneous chemical composition, hydrogen burning phase, helium burning phase, advanced phases of nuclear burning, final phase toward white dwarfs, and pre-main-sequence contracting phase. (C.E.S.)

8991 THE COSMICAL CONSTANT AND THE AGE OF THE UNIVERSE. Kenji Tomita and Chushiro Hayashi (Kyoto Univ.). Progr. Theoret. Phys. (Kyoto), 30: 691-9 (Nov. 1963).

The question on how much the age of an expanding universe can be lengthened by the introduction of the cosmical constant in relativistic cosmology is discussed. The age and the redshift-magnitude relation of galaxies are calculated for various values of the deceleration parameter and the cosmical constant, which characterize the universe models. The comparison with the observational data on the redshift-magnitude relation indicates that, if the effect of the evolution of galaxies is neglected, the age is not beyond 13×10^9 years and the cosmical constant can not be greater than 6×10^{-55} cm^{-2}. (auth)

8992 EXPECTED BEHAVIOUR OF THE DIRAC MONOPOLE IN THE COSMIC SPACE. Eiichi Goto (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 30: 700-18(Nov. 1963).

Dirac monopoles in cosmic space are expected to be accelerated by cosmic magnetic fields and decelerated mainly by Hubble's recession of galaxies. The estimated average energy of cosmic monopoles, carrying the Dirac's elementary magnetic charge, is $10^{20.4\pm1}$ ev with a rather sharp differential energy spectrum. The hypothesis that most of the extensive air showers (EAS) over 10^{18} ev are initiated by cosmic monopoles is not in conflict with any of previous experiments conducted in search for monopoles. Preliminary discussions about the structure of monopole-initiated EAS's and about more extensive monopole experiments are also given. (auth)

8993 EFFECTS OF COSMIC RAYS ON METEORITES. Masatake Honda (Tokyo Univ.), and James R. Arnold. Science, 143: 203-12(Jan. 17, 1963).

The production and measurement of radioisotopes in meteorites and their effects on the meteorites are discussed. Special attention is given to C^{14}. Time variations and cosmic-ray age are also discussed. (P.C.H.)

8994 SOLAR MINIMUM AND THE INTERNATIONAL YEARS OF THE QUIET SUN. Helen W. Dodson and E. Ruth Hedeman (Univ. of Michigan, Pontiac). Science, 143: 237-40(Jan. 17, 1963).

Criteria that serve as guides to the course of the solar cycle are summarized so that the current level of solar activity can be judged in trying to determine the time and the probability of protracted intervals of true solar quiet during the years designated as the International Years of the Quiet Sun (IQSY). Data are tabulated. (P.C.H.)

8995 AN ANALYSIS OF SOME MECHANISMS FOR THE DEVELOPMENT OF MAGNETIC FIELDS IN RADIO SOURCES. S. B. Pikel'ner (Sternberg Astronomical Inst., USSR). Soviet Astron.-AJ (English Trans.), 7: 463-70 (Jan.-Feb. 1964).

Several arguments are given against the hypothesis that the field of the Crab Nebula is a tangled galactic field. The possibility of local development of the field as a result of thermal currents, cosmic rays from stars, and diffusion of cosmic rays from compressed regions is considered. Self-induction leads to slow development of the field. The beam-instability mechanism can lead to rapid dissipation in strong currents, which however ceases as a result of electron heating. The thermal energy emitted during the formation of the field is computed. In strong fields it is relatively large, and this leads to a small performance coefficient. Therefore the energy of the shell and cosmic rays is insufficient for the development of a field. The cooling of oscillations due to radio-wave emission and cosmic-ray acceleration is insufficient. The necessary field can be formed either in very fine filaments or in weak currents—in this case the efficiency of the process is higher. For weak currents the dissipation mechanism based on collisions of ions with atoms is almost sufficient if the number of atoms in the nebula is not too small. Conditions under which this can be fulfilled are given. The analysis is of general significance. In particular, it can be applied to the problem of formation of the metagalactic field. (auth)

8996 STRUCTURE AND FAR ULTRAVIOLET RADIATION OF THE UPPER STELLAR ATMOSPHERE. I. CONTINUOUS EMISSION OF HYDROGEN AND HELIUM. G. M. Nikol'skii (Inst. of Terrestrial Magnetism, the Ionosphere, and Radio-Wave Propagation, Academy of Sciences, USSR). Soviet Astron.-AJ (English Transl.), 7: 512-18(Jan.-Feb. 1964).

The temperature T_k and the density n_k in the coronas of stable stars of various spectral types are computed under several assumptions. The temperature dependence of the generalized emission measure, $\varphi(T) = \int_h^\infty n^2 T^{-\frac{1}{2}} dh$, is found for various stars. The radiative recombination coefficient in the stellar atmosphere is computed for H I, $\lambda \leq 912$ Å; He I, $\lambda \leq 504$ Å; and He II, $\lambda \leq 228$ Å, as well as for O VIII, N VII, and C VI. Cool giants and supergiants can also form H II zones. (auth)

8997 STRUCTURE OF THE EQUATIONS OF COSMIC ELECTRODYNAMICS. M. A. Gintsburg (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Academy of Sciences, USSR). Soviet Astron.-AJ (English Transl.), 7: 536-40(Jan.-Feb. 1964).

The only possible linear generalization of the Maxwell equations leads to the dispersion of electromagnetic waves

in vacuo and to the exponential decrease of magnetostatic fields, thus intrinsically connecting these two domains of electromagnetic theory. The corresponding changes in the Maxwell equations become significant only at cosmical distances ($\sim 10^{11}$ cm). Thus the old classical problem, whether the velocity of light depends on its frequency, can be solved in a new way – by measuring the space distribution of cosmical magnetostatic fields. Measurements of the geomagnetic field yield an upper limit for the photon rest mass $\mu_{max} \sim 3 \times 10^{-47}$ g, while the most precise laboratory determinations of the velocity of light ($\Delta_c/c \sim 10^{-6}$) give a much higher value. The new limit, 10^{-47} g, excludes the possibility of detection of light dispersion by astronomical methods (observations of double stars, supernovae, etc.): the possible dispersion effect in vacuo is much smaller than dispersion in interstellar plasma. The determination of the true structure of the electromagnetic field equations is a new important aim of cosmical magnetic field measurements. (auth)

8998 CAUSE OF IONIZATION OF COMETARY MOLECULES. L. S. Marochnik (Astrophysical Inst., Academy of Sciences, Tadzhik SSR). Soviet Astron.-AJ (English Transl.), 7: 544-6(Jan.-Feb. 1964).

It is shown that the focusing of the magnetic field of the solar corpuscular stream leads to an increase in the concentration of protons in the stream. Even if the corpuscular stream ("wind") was extremely rarefied before collision with the comet, the increase of proton concentration is sufficient for explaining the observed lifetime of parent molecules before ionization by recharging $H^+ + M \rightarrow M^+ + H$ (M–a cometary molecule). The focusing of the field to the nucleus also makes it possible to understand the location of ions near the cometary nucleus. (auth)

Atomic Physics

8999 (TID-19958) THE SPECTRUM, THE EXCITATION AND IONIZATION CROSS SECTIONS FOR PHOTO PROCESSES AND FOR COLLISIONS, OF FIVE TIMES IONIZED OXYGEN. Final Report, June 1, 1961 to August 31, 1963. Carlos M. Varsavsky (P.E.C. Corp., Boulder Colo.). Contract AT(11-1)-1017. 37p.

The revision of some points in the application of the screening theory to photoionization cross sections and its extension to excitation cross sections by electron impact was undertaken. The essential work completed over the contract period is summarized. Different methods that can be used to calculate certain atomic parameters (cross sections, eigenvalues, etc.) in highly ionized systems are reviewed, with particular emphasis on their application to the O^{+5} ion. (D.C.W.)

9000 (TID-19959) THE HALL EFFECT IN LIQUID METALS. Bernard Springer (Chicago. Univ. and Chicago. Univ. Inst. for the Study of Metals). [1963]. Contract AT(311-1)-636. 53p.

A liquid metal in which the unscreened electron-ion interaction is the sum of spherically symmetric terms is assumed. Using an exact expression for the conductivity tensor in a magnetic field, it is shown that the Hall constant R is given by a constant times the frequency derivative of the resistivity, evaluated at zero frequency and zero magnetic field. Effects due to quantization of the electronic levels in the field are ignored. The theorem is then used to obtain an explicit theoretical expression for R in the form of a power series expansion in the pseudopotential. Calculation of R is done for Zn and it is shown that the series converges slowly if at all. It is concluded that the small pseudopotential approximation is not convenient for and possibly not valid for dealing with electrical transport in liquid metals. (auth)

9001 (TID-20002) ATOMIC BEAM SCATTERING STUDIES ON THE Li–Hg SYSTEM. VELOCITY DEPENDENCE OF TOTAL AND DIFFERENTIAL CROSS SECTIONS AS A ROUTE TO THE INTERACTION POTENTIAL. Peter J. Groblicki and Richard B. Bernstein (Wisconsin. Univ., Madison). Nov. 1, 1963. Contract AT(11-1)-1328. 91p.

Methods for the elucidation of the interatomic potential, taking advantage of quantum effects observed in the scattering of low reduced-mass systems at thermal energies are investigated. Experimental data on the velocity dependence of total and differential elastic cross sections for the Li–Hg system are presented and compared with theoretical predictions. (auth)

9002 (AEC-tr-6269) ANOMALOUS X-RAY SCATTERING OF HEAVY ATOMS IN THE REGION OF THE K AND L EDGES ACCORDING TO THE QUANTUM MECHANICAL THEORY OF DISPERSION. [PART] I. I. H. Eisenlohr and G. L. J. Muller. Translated for Los Alamos Scientic Lab., N. Mex., from Z. Physik, 136: 491-510(1954). 23p.

A part of an evaluation of the term in Waller's dispersion formula describing the anomalous dispersion of the L shell, the part of the scattering moment responsible for the anomalous dispersion of the L shell of heavy, hydrogen-like atoms is calculated. The scattering moment can be developed in a multipole expansion in the ratio of the L-shell radius to the primary waveiength. Each multipole has its own characteristic frequency dependence. (D.C.W.)

9003 INJECTION LUMINESCENT PUMPING OF $CaF_2:U^{3+}$ WITH GaAs DIODE LASERS. R. J. Keyes and T. M. Quist (Massachusetts Inst. of Tech., Lexington, Ky.). Appl. Phys. Letters, 4: 50-2(Feb. 1, 1964).

The 8400 Å radiation from Ga–As diode lasers was successfully used to pump a $CaF_2:U^{3+}$ laser. Additionally, an upper limit of <3 μsec was established for the relaxation time of the nonradiative transition from the $^4I_{9/2}$ level to the $^4I_{11/2}$ laser level in U^{3+}. This pumping technique combines high efficiency of input electric power conversion to laser output with reduction of heat dissipation in the pumped laser. (D.C.W.)

9004 ENERGY DISTRIBUTION OF CATHODE SPUTTERING OF METALS BY MERCURY IONS. M. B. Ben'yaminovich and V. I. Veksler (Tashkent State Univ.). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 29-37 (1963). (In Russian)

Energy spectra of sputtered Cu, Ni, W, Ta, Nb, and Mo atoms were investigated at a kinetic energy ≥10 ev. Targets were placed, as negative probes, in low-pressure mercury arc plasmas where sputtered atoms were partially ionized. The newly formed ions were pulled into a high vacuum area and analyzed. (R.V.J.)

9005 ANGULAR DISTRIBUTION OF SCATTERED IONS IN METAL TARGET BOMBARDMENT BY ALKALI IONS AT $V_i > \varphi$. A. A. Aliev, U. A. Arifov, and A. Kh. Ayukhanov (Inst. of Physics and Tech., Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 4, 86-91(1963). (In Russian)

Angular distributions of secondary ions produced by Rb^+ and Cs^+ bombardment of 25 × 5 × 0.02 mm Ta and Mo polycrystalline targets were studied $V_i > \varphi$. The results confirmed the concept of a deep reaction between the incident ions and target atoms. It is shown that the yield of scattered ions is reduced with incident ion pene-

tration into the surface. The maximum secondary ion intensity is directed normal to the target surface; with increased emission angle, ion decreases. (R.V.J.)

9006 EFFICIENCY OF PRODUCTION OF CHARACTERISTIC X RADIATION FROM PURE ELEMENTS BOMBARDED BY ELECTRONS. D. B. Brown and R. E. Ogilvie (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys., 35: 309-14(Feb. 1964).

Equations are presented that give the intensity (photons/electron steradian) of K characteristic x radiation produced by pure elements under electron bombardment at normal incidence. For values of ϕ (the angle between the x-ray beam and the specimen surface) between 0 and 90° the equations are $\nu_K = (\delta\omega/4\pi)N_K$ and $N_K = WRf(\chi)N\overline{Q}x_K + N_{Kf}$, where ν_K is the number of K quanta per incident electron radiated into solid angle $\delta\omega$ at takeoff angle ϕ, W is the fluorescence yield factor, R is a correction for loss of ionization due to electron back scattering, $f(\chi)$ is Castaing's absorption correction function, N is the number of atoms per unit volume, $\overline{Q}$ is an average over electron energy of the cross section for K shell ionization, x_K is the electron path length at which the energy of the electron drops to that necessary for K shell ionization, and N_{Kf} is the contribution due to secondary K shell ionization by high energy continuous x radiation. It is concluded that the predictions of this theory are in general in good agreement with available experimental data; further, that this theory shows certain advantages over those of Archard and of Green and Cosslett. Values of $f(\chi)$ are calculated and compared with the experimental work of Castaing and the calculations of Archard and Mulvey. (auth)

9007 SINGLE AND DOUBLE IONIZATION OF Ca BY ELECTRON IMPACT. Yozaburo Kaneko and Ichiro Kanomata (Tokyo Metropolitan Univ.). J. Phys. Soc. Japan, 18: 1822-5(Dec. 1963).

In order to examine the validity of the power law for multiple ionization by electron impact, the probability curves of single and double ionization of Ca were studied. The formation of Ca^{2+} is not a simple square function of electron energy, but it increases gradually above the threshold and has two or three maxima between 25 and 30 ev, then increasing again steeply. The steep increase at 31 ev agrees well with the curve obtained previously. It is suggested that three different kinds of processes contribute to the formation of Ca^{2+}. That is, process (I) which follows the square law corresponds to the direct ionization process, and process (II) which has some maxima is attributed to some autoionization processes, and process (III) which is linear to the energy is attributed to Auger ionization process caused from ionization of 3p electron. Discussion on formation of Ca^{+} is given. (auth)

9008 THE MEASUREMENT OF ABSOLUTE OSCILLATOR STRENGTHS FOR LINES OF NEUTRAL ATOMS. Robert B. King (California Inst. of Tech., Pasadena). J. Quant. Spectry. Radiative Transfer, 3: 299-303(Oct.-Dec. 1963).

Comments are made on the present status of absolute oscillator strengths of lines in atomic spectra and on methods of measurement of these quantities. The measurement of absolute oscillator strengths of lines of neutral metals by means of an atomic beam experiment is described and recent results are discussed. (auth)

9009 PERTURBATION TREATMENT OF THE MOLECULAR HELIUM ION. E. Corinaldesi, E. Remiddi, and F. Strocchi (Istituto Nazionale di Fisica Nucleare, Pisa, Italy and Università, Pisa, Italy). Nuovo Cimento (10). 30: 1563-4(Dec. 16, 1963).

The binding energy of the $^1\Sigma u$ state of the molecular helium ion was calculated by the perturbation method for diatomic molecules. The values obtained coincide with the experimental value. (C.E.S.)

9010 EXACT SOLUTION OF GENERALIZED PERCUS-YEVICK EQUATION FOR A MIXTURE OF HARD SPHERES. J. L. Lebowitz (Yeshiva Univ., New York). Phys. Rev., 133: A895-9(Feb. 17, 1964).

The Percus-Yevick approximate equation for the radial distribution function of a fluid is generalized to an m-component mixture. This approximation, which can be formulated by the method of functional Taylor expansion, consists in setting $\exp[-\beta\varphi_{ij}(r)]C_{ij}(r)$ equal to $g_{ij}(r)[e^{-\beta\varphi_{ij}(r)} - 1]$, where C_{ij}, g_{ij}, and φ_{ij} are the direct correlation function, the radial distribution function and the binary potential between a molecule of species i and a molecule of species j. The resulting equation for C_{ij} and g_{ij} is solved exactly for a mixture of hard spheres of diameters R_i. The equation of state obtained from $C_{ij}(r)$ via a generalized Ornstein-Zernike compressibility relation has the form $p/kT = \{[\Sigma\rho_i][1 + \xi + \xi^2] - 18/\pi \Sigma_{i<j}\eta_i\eta_j (R_i - R_j)^2 \times [R_i + R_j + R_iR_j(\Sigma\eta_iR_i^2)]\}(1 - \xi)^{-3}$, where $\eta_i = \pi/6$ times the density of the ith component and $\xi = \Sigma\eta_iR_i^3$. This equation yields correctly the virial expansion of the pressure up to and including the third power in the densities and is in very good agreement with the available machine computations for a binary mixture. For a one-component system the solution for C(r) and g(r) reduces to that found previously by Wertheim and Thiele and the equation of state becomes identical with that found on the basis of different approximations by Reiss, Frisch, and Lebowitz. (auth)

9011 INELASTIC ELECTRON-ATOM COLLISIONS UNDER NEAR-RESONANCE CONDITIONS: ANALYSIS OF TRANSITIONS INVOLVING STRONG COUPLING. Neal F. Lane and Chun C. Lin (Univ. of Oklahoma, Norman). Phys. Rev., 133: A947-61(Feb. 17, 1964).

A method was devised to calculate the cross sections of inelastic electron-atom collisions under near-resonance conditions. This method (referred to as the method of resonance distortion) consists of solving the limiting exact-resonance problem as the zeroth-order approximation and using this solution to obtain the first-order solution by an iteration procedure, and is particularly suitable for treating optically allowed transitions produced by electron impact where the coupling between the initial and final states is strong and of long-range type. Application of this method was made to a schematic model with an isotropic inverse-square interaction potential and to the problem of electron-atom collisions with ns → np transition. The general results indicate that for weak coupling the collision strengths calculated by the resonance-distortion scheme reduce to those calculated by the method of distorted waves, the resonance-distortion method and Seaton's B'II method give nearly equal partial cross sections for large l, and at very low l, the B'II partial cross sections are substantially larger than those determined from the resonance-distortion method. The total cross sections for the 3s → 3p transition in Na were calculated by the resonance-distortion method for various incident electron energies, and the results show better agreement with experiment than do those of the Born approximation and of Seaton's version of the modified Born approximation. (auth)

9012 2s AND 2p ELECTRON IMPACT EXCITATION IN ATOMIC HYDROGEN. Kazem Omidvar (Goddard Space Flight Center, Greenbelt, Md.). Phys. Rev., 133: A970-85 (Feb. 17, 1964).

A numerical calculation was carried out to evaluate the

3 × 3 cross-section matrix involved in the electron impact excitation of the ground state of H atom to the 2s and 2p levels. The method of solution is that of atomic eigenstates expansion. Instead of the iterative technique used by others, the definite integral terms in the coupled radial differential equations are eliminated through some linear transformation of the radial functions, thus avoiding iteration of these equations. The accuracy of the numerical integration is tested by satisfying the equation of reciprocity and the equation of continuity of currents with an error-to-value ratio less than 1 per 1000 on the average; and the maximum of this ratio, except for a few cases, was kept below 5%. The results are in agreement with the results of an iterative technique. To evaluate the effect of the long range and the centrifugal potential, a simple perturbation theory is developed. Only the 2s → 2p and the 2p → 2p cross sections are reported. The 2p → 2p cross section requires the solution of the sets of differential equations with different parities. Assuming the validity of the eigenstates expansion, it is found by comparison with the eigenstates expansion calculation that the Born approximation, despite its simplicity, gives meaningful results for low and close-to-the-threshold energies of the bombarding electrons. The effect of the exchange potentials on the cross sections is also investigated. Finally, an interesting structure of the 1s → 2s excitation cross section above threshold is found. (auth)

9013 REPULSIVE INTERACTION POTENTIALS BETWEEN RARE-GAS ATOMS. HETERONUCLEAR TWO-CENTER SYSTEMS. Adolf A. Abrahamson (City Coll., New York and Brookhaven National Lab., Upton, N. Y.). Phys. Rev., 133: A990-1004(Feb. 17, 1964). (BNL-7369)

A theoretical expression, previously applied only to homonuclear pairs of rare-gas atoms, was used to calculate the interaction energies U(R) for the corresponding heteronuclear two-center systems at internuclear separations R ranging from $0.01\alpha_0$ to $\sim 6.0\alpha_0$(α_0 = 0.529 Å). These results are compared with: (a) empirical data; (b) other calculations; (c) the geometric-mean rule $U_{AB} = (U_{AA}U_{BB})^{1/2}$; (d) the corresponding united-atom energies. With regard to (a) and (b), this comparison supports conclusions drawn previously from a study of the homonuclear pairwise interactions. That is, the present calculations, too, generally agree more closely with experiment than does either Bohr's screened Coulomb potential or Firsov's Thomas-Fermi type potential. Relation (c) is found to be satisfied, generally, to within a few percent. As for (d), calculations for the He–Ne and Ar–Kr systems indicate that, as R → 0, the electron energy of each system tends, approximately, to the appropriate empirical united-atom value. A similar study of other systems, including the light gases, metals, and certain diatoms, is in progress. (auth)

9014 EXPERIMENTAL DETERMINATIONS OF THE FIRST TOWNSEND IONIZATION COEFFICIENT IN HELIUM. Lorne M. Chanin and G. D. Rork (Honeywell Research Center, Hopkins, Minn.). Phys. Rev., 133: A1005-9(Feb. 17, 1964).

The first Townsend ionization coefficient α/p_0 (cm × Torr)$^{-1}$ was experimentally determined for an E/p_0 (volts/cm × Torr) range from 3 to 300 in cataphoretically cleaned helium. The results obtained were compared with several experimental and theoretical determinations of α/p_0. The present values are in agreement within the combined experimental errors with those of Davies, Jones, and Morgan. Comparison is also made with the experimental results of Townsend and MacCallum where good agreement is found except at their lowest E/p_0 values, where the present results lie below their corresponding data. At low E/p_0, the present results agree reasonably well with the theoretical values of Phelps and Dunlop except at very low E/p_0 where Dunlop's calculated values are considerably smaller than the present experimental results. The significance of the experimental method at very high E/p_0 where equilibrium conditions do not prevail is also discussed. (auth)

9015 YANG-LEE DISTRIBUTION OF ZEROS FOR A VAN DER WAALS GAS. P. C. Hemmer and E. Hiis Hauge (Norges Tekniske Høgskole, Trondheim, Norway). Phys. Rev., 133: A1010-15(Feb. 17, 1964).

The distribution of zeros of the grand partition function for a gas obeying van der Waals' equation of state (together with Maxwell's rule) is studied. For infinite temperature the zero distribution is located on part of the negative real axis, but with decreasing temperatures the distribution branches off the real axis circumventing the origin on both sides. Below the critical temperature the distribution forms a closed curve around the origin with a diameter decreasing exponentially to zero as T → 0. An additional tail of the distribution remains on the negative real axis at all temperatures, but with a density of zeros going linearly to zero with T → 0. (auth)

9016 CALCULATION OF THE g FACTOR OF HYDROGEN AND THE ALKALI ATOMS TRAPPED IN RARE-GAS SOLIDS. David Young Smith (Univ. of Illinois, Urbana and Univ. of Rochester, N. Y.). Phys. Rev., 133: A1087-97 (Feb. 17, 1964).

The variational method of calculating g-factor shifts for atomic hydrogen trapped in a rare-gas solid is applied to the case of the alkali metals as impurities. An alternate derivation of the results is given, and a simple physical model is discussed. The calculated shifts are compared with the experimentally observed ones for H, Li, Na, and K trapped in Ne, Ar, and Kr. Reasonable agreement is obtained if it is assumed that where two resonances were reported the impurities are trapped at substitutional and octahedral interstitial lattice sites. The connection between the variational formalism and a previous perturbation treatment of Adrian is discussed, and it is shown that a reinterpretation of the latter yields improved agreement with experiment. Crude estimates of the relaxation about substitutional and interstitial impurities are also given. (auth)

9017 EFFECT OF TEMPERATURE AND PRESSURE ON THE ELECTRON PARAMAGNETIC RESONANCE SPECTRA OF SUBSTITUTIONAL IMPURITIES IN CUBIC $SrTiO_3$. L. Rimai, T. Deutsch, and B. D. Silverman (Raytheon Co., Waltham, Mass.). Phys. Rev., 133: A1123-4(Feb. 17, 1964).

The electron paramagnetic resonance spectra of Fe^{3+}, Gd^{3+}, Eu^{2+}, and Cr^{3+} in cubic $SrTiO_3$ were studied as a function of hydrostatic pressure to 10,000 bars and as a function of temperature between 300 and 110°K. The optical spectrum $Cr^{3+}:SrTiO_3$ was examined at 4.2, 77, and 300°K. From a comparison of the pressure data for Fe^{3+} and Cr^{3+} with those for these ions in other hosts, it is deduced that the local compressibility at the site occupied by these impurities is enhanced by a factor of two over the bulk compressibility. The isoelectronic ions Gd^{3+} and Eu^{2+} show a striking difference in the temperature dependence of the ground-state cubic field parameter, b_{40}. This difference is due to the polarization of the lattice by the uncompensated charge of Gd^{3+} and manifests itself as a Curie-Weiss term in the temperature dependence of b_{40}. This polarization effect is also seen in the temperature dependence of b_{40} for

Fe^{3+}. Theoretical justification for the temperature dependence of this term is given. (auth)

9018 CALCULATION OF AUTOIONIZATION LEVELS IN He. P. G. Burke (Atomic Energy Research Establishment, Harwell, Berks, Eng.), D. D. McVicar, and K. Smith. Phys. Rev. Letters, 11: 559-61(Dec. 15, 1963).

The calculation is described; and the positions, widths, and autoionization probabilities for the ^1S, ^1P, and ^3P states in He are presented. Experimental results in agreement with the calculations for ^1P levels are cited. Also, the predictions for the lowest ^1S and ^3P resonances were later confirmed experimentally to a large extent. (D.C.W.)

9019 BREMSSTRAHLUNG RADIATION OF AN ULTRARELATIVISTIC ELECTRON IN A CRYSTAL. N. P. Kalashnikov (Inst. of Engineering and Physics, Moscow). Soviet Phys.-Solid State (English Transl.), 5: 1405-7(Jan. 1964).

An analytical expression was obtained for the bremsstrahlung radiation spectrum in crystals. The position of the maximum was found for small quanta. (auth)

9020 ELECTRON PARAMAGNETIC RESONANCE OF Eu^{2+} IONS IN BaF_2 AND SrF_2 SINGLE CRYSTALS. V. M. Vinokurov, M. M. Zaripov, V. G. Stepanov, G. K. Chirkin, and L. Ya. Shekun (Kazan State Univ.). Soviet Phys.-Solid State (English Transl.), 5: 1415-17(Jan. 1964).

The EPR of Eu^{2+} ions occurring in the form of an impurity (~0.05%) in synthetic BaF_2 and SrF_2 single crystals (CaF_2-type lattice) was observed. In both cases the spectrum is described by a spin hamiltonian of cubic symmetry. The constants of the hamiltonians are compared with analogous constants for Eu^{2+} in CaF_2. Additional lines due to the transitions $\Delta M = \pm 1$, $\Delta m = \pm 1$ are discussed. (auth)

9021 PARAMAGNETIC RESONANCE OF Nb^{4+} IONS IN ZIRCON SINGLE CRYSTALS. V. M. Vinokurov, M. M. Zaripov, V. G. Stepanov, G. K. Chirkin, and L. Ya. Shekun (Kazan State Univ.). Soviet Phys.-Solid State (English Transl.), 5: 1487-8(Jan. 1964).

Complex electron paramagnetic resonance spectra were found in many natural single crystals of zircon. At 77°K characteristic spectra of ten lines of equal intensity and practically equal separation were observed. These spectra were interpreted as due to Nb^{4+} ions. (C.E.S.)

9022 COLLISIONS OF SLOW ELECTRONS WITH ATOMS. V. Ya. Veldre. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 3-10(1963). (In Russian)

The articles presented in the collection are reviewed. Excitation of the sodium atom by slow electrons was calculated with the use of integral equations. Exchange and strong coupling were taken into account for one energy value of the incident electron. The elastic scattering of slow electrons by lithium was also calculated with exchange being taken into account. The effective scattering cross sections for electrons having energies up to 50 ev by Li, Na, K, and Cs were estimated by taking into account strong coupling according to Seaton's method. The second Born approximation, which is much simpler than the method of integral equations, was used to calculate the effective elastic scattering cross section of electrons on hydrogen atoms. The agreement between theory and experiment is good for elastic scattering, but is lacking in the case of excitation and ionization. Coupling between the 1s-2s and 1s-2p levels in hydrogen was taken into account in calculating the elastic scattering of electrons and excitation of the 2s and 2p levels. Exchange and strong coupling between levels were calculated by solving the equations directly on a computer. The total orbital moment was considered. Coupling between the 1s, 2s, and 2p levels were taken into account to calculate the excitation cross section of the 2s and 2p levels. The distortion of the electron wave function by the coulombic ion field was taken into account in calculating resonance widths, and shifts. The Born approximation was used to calculate the ionization cross section of the hydrogen atom. (56 references) (TTT)

9023 TAKING STRONG COUPLING INTO ACCOUNT IN ELECTRON COLLISIONS WITH THE HYDROGEN ATOM. R. Ya. Damburg. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 11-16(1963). (In Russian)

The strong coupling between the 1s, 2s, and 2p levels were taken into account with exchange being neglected. Partial cross sections were tabulated for the various levels with the total moment being kept in mind. The set of four differential equations was solved directly on a computer. The values are in good agreement with the results of Burke presented in the Proc. Phys. Soc., 80, 1962. Coupling between other levels such as between the 1s-2s level, and especially between the 1s-2p level, has a substantial effect on the elastic scattering cross section $\sigma(1s\text{-}1s)$. This effect is removed on taking exchange into account. The 2s-2p coupling has almost no effect on the calculation of $\sigma(1s\text{-}1s)$. It is shown that the second Born approximation in which strong coupling is taken into account gives a better estimate of the contribution of the higher partial waves (for example, $L > 5$) to the total cross section. The total cross sections for the 1s-2s and 1s-2p transitions are plotted for electron energies of 10 to 50 ev. (TTT)

9024 SLOW ELECTRON COLLISIONS WITH HYDROGEN ATOMS. R. Ya. Damburg and R. K. Peterkop. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 17-35(1963). (In Russian)

The excitation cross sections of the hydrogen atom were computed by taking into account the strong coupling of all three 1s, 2s, and 2p levels along with exchange effects. The calculations were carried out for 5 values of the total orbital moment: $L = 0, 1, 2, 3$, and 4. At $L > 0$, both scattered waves (with moments $L \pm 1$) were considered in the excitation of the 2p level. The linear integral-differential equations were solved directly on a digital computer. Elements of the T-matrix were tabulated for the singlet (+) and triplet (–) cases. The direct, exchange, interference, average, single, and triplet partial cross sections, and also the sum of these cross sections, were tabulated for elastic scattering and excitation of the 2s and 2p levels at $L = 0, 1, 2, 3$, and 4. Consideration of all couples between the 1s, 2s, and 2p levels had a significant effect on the excitation cross section of the 2s and 2p levels. The calculated results for the total average cross section $\sigma(1s\text{-}2s)$ and for the exchange cross section were in agreement with experimental results. The theoretical partial excitation cross section for the 2p level did not agree with the experimental value. The reason for the disagreement was not clear. The calculated elastic scattering cross section in the ground state was in agreement with the experimental value. (TTT)

9025 THE ASYMPTOTICS OF FUNCTIONS WHICH DESCRIBE PARTIAL WAVES. R. Ya. Damburg. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 37-41(1963). (In Russian)

In finding the partial scattering cross section of an electron on a hydrogen atom, a set of differential equations must be solved that involve the characteristics of the state of the atom $n l_1$, the orbital angular momentum $\hbar[l_2(l_2+1)]$, the wave vector of the colliding electron k_n, the total angular moment of the system $\hbar[L(L+1)]$, and the potential μ_λ.

On determining the p- and q-matrices, it is possible to find the reactance matrix R, the scattering matrix S, the transition matrix T, and the M-matrix. In solving the set of equations describing strong coupling of the 1s, 2s, and 2p levels, potentials with $\lambda = 1$ and 2 enter the equations, and the function $F_1(a/r)$ cannot be considered as a superposition of spherical Bessel functions. However, convergence of the series can be improved by proper choice of an exponential function at large values of r. At energies close to the threshold value (at values of $k_2^2 = k_1^2 - 0.75$ equal to 0.01 to 0.001), the rate of convergence is considerably improved, and satisfactory solutions are obtained for strong coupling of the 1s-2s-2p levels even at $k_1^2 = 0.001$. (TTT)

9026 POSITRON COLLISIONS WITH HYDROGEN ATOMS. R. Ya. Damburg and E. M. Karule. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 43-5(1963). (In Russian)

Partial cross sections were calculated for the elastic scattering cross section at the ground state $\sigma(1s\text{-}1s)$, the cross section $\sigma(2s\text{-}2s)$ at the excited 2s-state, the cross section $\sigma(1s\text{-}2s)$ for excitation of the 2s-level, the cross sections $\sigma(1s\text{-}2p)$ and $\sigma(2s\text{-}2p)$ for excitation of the 2p level, and the cross section $\sigma(2p\text{-}2p)$ for elastic scattering in the excited 2p-state. The momentum of the incident positron was varied from k = 0.9 to k = 2.0 (k = wave vector of the positron). The total orbital moment L was taken into account. Partial cross sections are tabulated for L = 0, 1, 2, 3, and 4 with strong coupling between the 1s, 2s, and 2p levels being taken into account. The differential equations were solved numerically. Positron formation was not taken into account, but this factor is less important than strong coupling between the levels in calculating the elastic scattering cross section. The total scattering cross sections in the 1s-state and the excited 2s- and 2p-states are tabulated. (TTT)

9027 RESONANCE PHENOMENA IN ELECTRON SCATTERING BY HYDROGEN ATOMS. R. Ya. Damburg and R. K. Peterkop. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 47-53(1963). (In Russian)

Resonance phenomena occur as a result of the formation of a metastable, compound nucleus. A similar type of resonance was investigated for elastic electron scattering by hydrogen atoms near the excitation threshold of the 2s level. Virtual excitation of the 2s level was also taken into account as a reaction mechanism. M-matrix formalism was used, because the elements of the M-matrix are a smoothly varying function of energy near the threshold, where the cross section undergoes a significant change. Values of the matrix $M_{ij}(E)$ at energies exceeding the threshold energy (E > 0.375 at. units) were found by numerical integration on a computer. Values of the matrix M_{ij} and of the effective radius R_{ij} were compared at the threshold with strong coupling, and without strong coupling, but with correction of the electron wave function for distortion of the coulombic field. The role of strong coupling decreased on taking exchange into account. On using the approximation of an effective radius, resonance effects could be detected at energies below the threshold energy. Coupling with the 2p level can significantly change the position and form of the resonances. An idea of resonance phenomena below the threshold energies can be obtained by taking strong coupling into account and by correcting the electron wave function for distortion of the coulombic field. A maximum near the threshold was observed in the singlet p cross section. (TTT)

9028 THE ROLE OF POLARIZATION EFFECTS IN INELASTIC ELECTRON COLLISIONS WITH AN ATOM. G. F. Drukarev and V. D. Ob'edkov. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 55-65(1963). (In Russian)

The effect of polarization of an atom on the excitation function near the threshold is especially pronounced at low electron energies, after the electron has collided with the atom. A variation method was used in finding the explicit form of the polarization potentials with an adiabatic approximation. A simple computational formula, which was obtained by varying one parameter, is presented as an example. The approximate polarization potential can be found for any level by calculating the matrix element, and not by solving the corresponding equation each time. The excitation energy was investigated as a function of the energies k_n^2 of the scattered particles. Polarization of the atom was found to have a substantial effect on the scattering and excitation amplitudes at low energies of the incident and inelastically scattered particles. (TTT)

9029 RADIAL EQUATION IN ATOMIC COLLISION THEORY. I. INTRODUCTION OF THE POLARIZATION POTENTIAL. L. A. Vainshtein (Lebedev Inst. of Physics, Moscow). Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 67-85(1963). (In Russian)

Polarization of the atom must be taken into account in calculating elastic scattering. The polarization potential is introduced into the usual set of radial equations, and the equations are solved by using the method of successive approximations. The essential feature of the polarization potential is its non-local character. On introducing the polarization potential, the solution of an infinite series of integro-differential equations is replaced by the solution of a set of independent equations, and the calculations are still complex. However, the physical meaning of the equations containing the polarization potential is more obvious, and it is easier to formulate approximate methods of solutions for the polarization potential in many cases than it is for wave functions. The polarization potential is estimated by a second-order approximation, by an adiabatic approximation, and by an approximation which takes into account the non-local character of the potential. (TTT)

9030 A COULOMBIC-BORN APPROXIMATION FOR s-s TRANSITIONS. M. K. Gailitis. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 87-92(1963). (In Russian)

In calculating the excitation cross section of ions by electrons close to the threshold energy, it is necessary to take into account distortion of the electron wave by the coulomb field of the ion. With the use of the Born approximation, the excitation cross sections were calculated on a digital computer for the 1s-2s and the 1s-3s transitions in hydrogen-like ions having a charge (Z) of 2 to 10. The results show that the excitation cross section is almost inversely proportional to Z^4 for the same transition in atoms with different values of Z, or in other words, to the square of the energy of the transition. This proportionality holds for all transitions, not only for s-s transitions. The angular distribution of the scattered electrons is non-isotropic, and has a maximum in the backward direction near the excitation threshold. (TTT)

9031 THE USE OF THE BETHE APPROXIMATION IN CALCULATING THE EXCITATION CROSS-SECTION OF AN ION BY ELECTRONS. M K. Gailitis. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 93-7(1963). (In Russian)

The Bethe approximation used in calculating the excitation of an atom by an electron must be modified in order to take into account the distortion of the electron wave by the coulombic field of the ion. The excitation cross section for an optically allowed transition was calculated on a digital computer as a function of $E/\Delta E$ for various values of $\Delta E/Z^2$. E is the energy of the incident electron, and ΔE is the transition energy. Z is the charge of the ion. The

results are compared with those obtained by the Bethe approximation (which does not take the coulombic distortion into account). The value of $\Delta E/Z^2$ is < 3 on exciting an optical level. The cross section decreases monotonically with increasing value of E, and depends only slightly on $\Delta E/Z^2$. (TTT)

9032 RESONANCE IN ELECTRON SCATTERING BY IONS. M. K. Gailitis. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 111-13(1963). (In Russian)

The Bethe approximation was applied to the excitation of an ion with allowance for distortion of the electron wave function by the coulombic field of the ion. Partial cross sections were estimated as a function of ion charge and of energy of the incident electron. Expressions were obtained for the width and shift of Breit-Wigner type of resonances. These results were utilized in determining resonance effects for electrons scattered by positively charged, hydrogen-like ions. It is shown that the greater the charge of the ion, the higher and narrower are the resonance maxima. It is found that $\Gamma/D \sim 1/Z^2$, and $\Delta/D \sim 1/Z$. Here Γ is the resonance width; Δ is the displacement of the resonance, and D is the distance between resonances. (TTT)

9033 THE CONSERVATION OF PARTICLE FLOW IN COLLISIONS. R. K. Peterkop. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 115-20(1963). (In Russian)

In calculating the effective ionization cross section, it is shown that the flow of particles is not conserved in three-dimensional space. A wave function describing the collision is broken down into a series involving the coordinates of the incident electron and of the atomic electron. The flow of particles across a plane is conserved. It is shown that the total flow of bombarding and atomic electrons is conserved only in the absence of ionization. The formula indicates that the difference in electrons is due to the number of electrons knocked out of the atom in the process of ionization. It is pointed out that the ionization cross section is high by a factor of two, if it is assumed that the total number of particles is conserved. The same error can be made in considering removal of a neutron from the Be nucleus by another neutron. (TTT)

9034 CALCULATING THE IONIZATION CROSS-SECTION OF THE HYDROGEN ATOM WITH THE USE OF PLANE WAVE APPROXIMATIONS. V. Ya. Veldre and I. Zh. Vinkaln. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 121-5(1963). (In Russian)

In calculating the effective ionization cross section with the use of a Born approximation, the incident and scattered electrons are described by a plane wave, and the electron knocked out of the atom is described by a coulombic wave function for a continuous spectrum. In order to study the effect of the electron wave function on the ionization cross section, plane wave functions were used in describing both electrons after the ionization. The integrals were solved on a digital computer. The total ionization cross-section was determined with exchange being taken into account. The calculated value of the cross section exceeded the experimental value of a factor of two, even though non-orthogonality of the wave function and exchange were taken into account. The values differ by a factor of three, if non-orthogonality of the wave function is not taken into account. These results show that it is very important to select the electron wave function correctly. (TTT)

9035 IONIZATION OF THE HYDROGEN ATOM BY SLOW ELECTRONS. V. Ya. Veldre and E. M. Karule. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 127-34(1963). (In Russian)

In collisions of slow electrons with a hydrogen atom, the Born approximation is not reliable, and it is necessary to take into account distortion of the incident electron wave function by the field of the atom before and after the collision. Both electrons are described by coulombic functions. The calculations were carried out with and without taking exchange into account. The incident electron energy was from 13.7 to 68 ev. All the computations were performed on a digital computer. The cross section for the triplet case is much smaller than the partial s cross section for the singlet case. The cross section without exchange is approximately twice the cross section with exchange. On taking into account the distortion of the incident wave, the cross section is about 20% greater than the cross section obtained by the modified Born approximation. It was not possible to compare the cross sections with experimental data, since the s cross section is a small part of the total cross section. (TTT)

9036 IONIZATION OF THE HELIUM ATOM NEAR THE THRESHOLD ENERGY. V. Ya. Veldre and A. V. Lyash. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 135-8(1963). (In Russian)

Ionization of the helium atom by slow electrons was computed by neglecting exchange and by taking into account only the s-wave for the incident and atomic electrons. The coulombic wave function of the electron was replaced by the first term of a Bessel series. An expression was obtained for the effective ionization cross section, and the computations were carried out on a digital computer. The calculated cross sections for the single ionization of the helium atom lie below the experimental values, and below the values of Geltman reported in Phys. Rev., 102: 171 (1956). (TTT)

9037 IONIZATION OF THE HELIUM ATOM ACCOMPANIED BY EXCITATION. A. V. Lyash. Tr. Inst. Fiz., Akad. Nauk Latv. SSR, 13: 139-40(1963). (In Russian)

Ionization of the helium atom with excitation of the atomic electron by slow electrons can be solved by taking into account the p-wave for the incident electron and the s-wave for the liberated electron, and by assuming excitation of the atomic electron from the ground state to a state with $l = 1$. An expression was derived for the effective ionization cross section of the helium atom, and the numerical results from the digital computer are presented in the form of a graph. Ionization of an incident s-wave of the helium atom with excitation of an atomic electron to a state with $l = 1$, and scattering of a p-wave was also considered at the same time. The cross section of this process is equal to zero in view of the orthogonality of the wave functions for the system "incident electron and helium atom." (TTT)

9038 ON THE INTENSITY OF MUTUALLY-INDUCED X-RAY FLUORESCENCE BETWEEN ELEMENTS. Chi Chen, Hua-lin Li, and Jia-yen Din. Wu Li Hsueh Pao, 19: 727-34(Nov. 1963). (In Chinese)

A formula is derived for the intensity of mutually-induced x-ray fluorescence between elements and is found to be in agreement with experiment. (auth)

9039 DETERMINATION OF MEAN CROSS SECTIONS OF ELECTRON COLLISIONS WITH NEUTRAL ATOMS IN WEAKLY IONIZED GASEOUS MIXTURE. E. P. Zimin and V. A. Popov. Zh. Prikl. Mekhan. i Tekhn. Fix., No. 5, 142-3(Sept.-Oct. 1963). (In Russian)

Mean cross sections were determined for electron collisions with neutral atoms at 1900 to 2300°K. The cross sections were determined by radio wave attenuation in the combustion products of methane–oxygen mixtures with potassium. (R.V.J.)

9040 IONIZATION EQUILIBRIUM BEHIND A SHOCK FRONT IN AN ATOMIC GAS. L. M. Biberman and I. T. Yakubov (Moscow Inst. of Power Engineering). Zh. Tekhn. Fiz., 33: 1344-53(Nov. 1963). (In Russian)

Kinetics of ionization equilibrium behind a shock front in an atomic gas was analyzed. It is shown that electron heating processes in elastic collisions with atoms and ions and absorption in nonequilibrate regions play the most important roles. Calculated relaxation lengths are in good agreement with experiment. (tr-auth)

9041 DETERMINATION OF CROSS-SECTIONS FOR ION-ATOM INTERCHANGE REACTIONS. Manuel Gaspar Menendez. Thesis, Gainesville, Fla., Univ. of Florida, 1963. 66p.

Two new experiments for the study of ionic collisions are a wide aperture d-c retardation experiment and a double mass spectrometer experiment, which employs a r-f mass spectrometer for identification of ionic collision products. The combination of the 2 experiments can lead to accurate results for systems which scatter primarily in the forward direction. The d-c retardation experiment yields the total inelastic cross section and in many cases gives a good indication of the energetics of the various reactions by a retardation analysis of the product ions. The r-f experiment employs the same reaction region and d-c potential configurations as the d-c experiment but includes a wide aperture r-f mass spectrometer and a target to collect and monitor the primary beam after passage through the reaction region. The r-f mass analysis region identifies, within limits set by the mass analyzer resolution, the various species formed by collisions. The r-f experiment can also give accurate relative cross sections for the various possible inelastic processes. The 2 systems studied were H_2^+, Ar, and H_2^+, H_2 in the energy range from 12 to 130 v incident ion energy. In the H_2^+, Ar system it was possible to separate three inelastic processes: charge transfer; ion-molecule reaction; and collision-induced dissociation, on the basis of the d-c retardation experiment alone. These processes are discussed. The H_2^+, H_2 system was studied in the d-c retardation experiment and in the r-f experiment. The charge transfer cross section for H_2^+, H_2 also showed "fine structure." This is discussed in the same terms as that used for the H_2^+, Ar charge transfer. (M.P.G.)

9042 INELASTIC COLLISIONS OF RARE GAS IONS AND EXCITED ATOMS WITH NEUTRAL MOLECULES. Morris Jacob Weiss. Thesis, Gainesville, Fla., Univ. of Florida, 1963. 51p.

A high-resolution mass spectrometer was used to measure the inelastic cross sections for the ion-molecule reactions $Ar^+ + H_2 \rightarrow ArH^+ + H$ and $Ar^+ + D_2 \rightarrow ArD^+ + D$ in the energy range 60 to 215 ev. The cross sections were found to be in the ratio of ~2:1 with the first reaction exhibiting the larger cross section. The cross sections were found to vary inversely with the 3/2 power of the energy in the range 60 to 155 ev, rapidly leveling off to zero energy dependence beyond 155 ev. The ion source used for the production of positive ions was also employed for the production of He and Ar metastable atoms for studying the Penning ionization processes of the type $A^* + XY \rightarrow X^+ + Y + A + e + k.e.$ Here A^* is the metastable atom involved in the collision with a molecule, XY. The target gases methane, ethane, O, and N were used. Several ion fragments resulted from the inelastic collisions of methane and ethane with the metastable atoms. The resulting mass spectra of such fragment ions were compared to the spectra obtained from conventional electron bombardment studies. The measurements have demonstrated, for the first time, that fragment ions are formed in a Penning ionization process, provided the metastable atom has sufficient energy. These ions have been identified by mass spectroscopy, and significant differences in their relative abundances, as compared with those observed for electron impact, have been observed. Information relative to the upper limits for the appearance potentials of these ions and the mode of fragmentation was obtained. (M.P.G.)

9043 THE INTERACTION OF He WITH He^+. Patrich Ned Reagan. Thesis, Austin, Tex., Univ. of Texas, 1963. 108p.

A quantum mechanical variational calculation of the electronic energy of the $^2\Sigma_u^+$ state of He_2^+ has been carried out using a 26-term valence-bond wave function. Application of the equation $D_e(He_2^+) \geq E_{exp}(He + He^+) - E_{calc}(He_2^+)$ results in $D_e \geq 2.24$ ev as a rigorous lower bound to the binding energy. The best previous estimates of $D_e(He_2^+)$ are $D_e \geq .84$ ev obtained from calculations using a one-term valence-bond wave function and $D_o \geq 1.4^{+.3}_{-.1}$ ev from electron impact experiments. The calculated value of R_e is 2.075 a.u. Extrapolation of the Rydberg series of He_2^* results in the experimental value $R_e(He_2^+) = 2.05$ a.u. Electron impact experiments have established the reaction $He^* + He \rightarrow He_2^+ + e$ as a mechanism of formation of He_2^+. The present calculation shows conclusively that all He excited states of the third principal quantum level are energetically possible in this mechanism of reaction and that states of the second principal quantum level do not have sufficient energy to be involved. (Dissertation Abstr.)

9044 A SINGLE-CENTER WAVE FUNCTION FOR THE GROUND STATE OF THE HeH^+ MOLECULAR ION. Joe Don Stuart. Thesis, Austin, Univ. of Texas, 1963. 99p.

An ab initio quantum mechanical calculation of the electronic energy as a function of the internuclear separation, R, of the ground state ($^1\Sigma^+$) of the HeH^+ molecular ion was carried out using a 30-term wave function centered on the He nucleus. The wave function was constructed by the method of superposition of configurations, with basis orbitals constructed from Slater-type atomic orbitals. The calculated energy is 0.06 ev above the experimental energy at $R = \infty$ (He atom) and is 0.08 ev above the experimental energy at R = 0 (Li^+ ion). In the region R = 1.2 to 1.6 amu, the calculated energy is at most 0.11 ev above the energy obtained with a very accurate James- and Coolidge-type wave function. For 1.6 amu $< R < \infty$ and for $0 < R < 1.2$ amu, the calculated energy is the most accurate yet obtained. A study of the convergence of the calculated energy with respect to the addition of terms to the single-center wave function indicates that the calculated energy is in error by less than 0.6 ev at any value of R. The calculated curve of electronic energy vs. internuclear separation is more accurate than any previously calculated curve for the ground state of HeH^+ that extends over the entire range of R. The success of this type of single-center approach in the case HeH^+ suggests that the same type of approach would be useful in electronic energy calculations of other molecules of the form XH^+ for which $I(X) < I(H)$. (Dissertation Abstr.)

9045 [PARTICLE-SURFACE COLLISIONS.] Earl T. Kinzer, Jr., and Charles M. Chambers, Jr. 41p. (CONF-328-7)

From American Physical Society Southeast Section 1963 Spring Meeting, Knoxville, Tenn., Apr. 1963.

The mechanical processes involved in the collisional interaction between a gas particle and a crystal surface

are investigated by means of a modified one-dimensional discrete particle model and elastic continuum models. Classical mechanics is used throughout. (C.E.S.)

9046 FORBIDDEN ELECTRONIC TRANSITIONS IN XeF_2 AND XeF_4. Eugene S. Pysh, Joshua Jortner, and Stuart A. Rice (Univ. of Chicago). 64p. (CONF-117-37)

From American Chemical Society 145th National Meeting, New York, Sept. 1963.

Transition strengths were measured for the weak 2330 Å band in XeF_2 (f = 0.002) and for the two weak bands in XeF_4 at 2280 Å (f = 0.009) and 2580 Å (f = 0.003). To investigate the origins of these weak transitions, the possibilities of vibronic and singlet-triplet transitions in XeF_2 and XeF_4 were examined. Using the Herzberg-Teller theory of vibronic transitions and a molecular orbital treatment of excited electronic states, estimated strengths of the relevant vibronic transitions were calculated to be f = 0.001 for both XeF_2 and XeF_4. The vibronic band in XeF_2 borrows intensity from the symmetry allowed $^1A_{1g} \rightarrow {}^1A_{2u}$ transition at 1580 Å (f = 0.45), while in XeF_4 the major contribution to the vibronic band is from the symmetry allowed $^1A_{1g} \rightarrow {}^1E_u$ transition at 1325 Å (f = 0.8). A temperature dependence of the intensity of the 2330 Å band in XeF_2 was observed and found to be less than that predicted by the Herzberg-Teller theory. The estimated strength of the singlet-triplet transition in XeF_2 corresponding to the singlet-singlet transition at 1580 Å is shown to be small ($f \leq 10^{-4}$) in spite of a heavy atom effect; the small transition strength persists because of the lack of nearby excited states of the required symmetry. In XeF_4 the triplet excited state ^3E_u corresponding to the singlet-singlet transition $^1A_{1g} \rightarrow {}^1E_u$ at 1840 Å (f = 0.22) is permitted by group theoretical selection rules to mix with its own singlet state. Using an intermediate coupling scheme the estimated intensity of this singlet-singlet transition is calculated to be f = 0.007. The theoretical estimates of the symmetry and spin forbidden transition strengths are used for the assignment of the weak electronic transitions in the xenon fluorides. (auth)

Cosmic Radiation

Refer also to abstract 8916.

9047 (D1-82-0257) ATMOSPHERIC NEUTRON FLUX MEASUREMENTS. Joleroy Gauger (Boeing Scientific Research Labs., Seattle). May 1963. 48p.

The energetic neutron flux at atmospheric depths from 160 gm cm^{-2} to 300 gm cm^{-2} was measured over latitudes extending from the equator to 55°N geomagnetic. Comparison of data with previous measurements indicates that at the time of these measurements the neutron spectrum is steeper than that determined by Hess for neutrons of E > 60 Mev, but is of the same form for E < 10 Mev. An anomalous increase in the flux of neutrons of E > 60 Mev was detected on July 21, 1962 over a region from 50° to 55°N geomagnetic. The increase is possibly attributable to a dumping of protons temporarily trapped in the slot between the inner and outer Van Allen zones. (auth)

9048 A SOLAR ANISOTROPY IN COSMIC RADIATION, VIEWED FROM A TERRESTRIAL FRAME OF REFERENCE. R. M. Jacklyn (Dept. of External Affairs, Melbourne and Univ. of Tasmania, Hobart, Australia). Nature, 200: 1306-7(Dec. 28, 1963).

Co-ordinate transformations that relate diurnal variation, amplitude, and maximum amplitude characteristics to those of a solar anisotropy specified in the frame of reference in which its orientation is fixed are described. The method outlined is given to indicate the need for correct transformations: when the characteristics of the anisotropy in its rest framework are to be deduced from the annual mean daily variation observed in the terrestrial frame of reference, after accounting for the influence of the atmosphere and the Earth's magnetic field; and when the day-by-day contributions that specified anisotropy makes to the daily variation and to the total intensity of cosmic radiation in the terrestrial frame of reference are to be determined and the seasonal effects calculated. (P.C.H.)

9049 LONG-TERM CHANGES IN THE ENERGY SPECTRUM OF PRIMARY COSMIC RAYS AND THEIR EFFECT ON COUPLING CONSTANTS OF SECONDARY COMPONENTS. R. P. Kane (Physical Research Lab., Ahmedabad, India). Nuovo Cimento (10), 30: 681-99 (Nov. 1, 1963).

Using data from several neutron monitors, cubical mesn telescopes, and ionization chambers in operation since 1954, the energy spectra ($A \cdot E^{-\nu}$) of long-term variations of cosmic-ray intensity are determined. For monthly means, ν ranges from 0.8 to about 1.2, occasionally higher. If maximum and minimum values of every month are treated separately, ν for maxima is ≥1.0 and always greater than ν for minima, indicating a flatter spectrum for the superimposed variations causing minima. With changes of primary spectrum, coupling constants also change from year to year. New coupling constants for a sample period (pre-Forbush-decrease period July 8 to 10, 1959) are evaluated and compared with those of Webber and Quenby. Differences observed are small. For Forbush decreases, the spectrum exponent ν seems to vary in a wide range, 0.4 to 0.9. (auth)

9050 THE RELATION BETWEEN COSMIC γ-RAYS AND SYNCHROTRON X-RAYS. G. W. Clark (Massachusetts Inst. of Tech., Cambridge). Nuovo Cimento (10), 30: 727-33(Nov. 1, 1963).

A quantitative relation between the intensities of cosmic γ-rays with energies near 10^{14} ev and x rays generated by synchrotron emission of cosmic electrons is derived on the basis of the fact that these two radiations have a common energy source in the interactions between cosmic-ray nuclei and interstellar matter. The relation depends on the intensity of the magnetic field in the region of production. Quantitative estimates based on recent data indicate that synchrotron x rays may constitute a significant component of cosmic x rays below 3 Å at high galactic latitudes. It may therefore be possible to obtain a new measurement of the interstellar magnetic field by a comparison of the intensities of cosmic x rays and ultra-high-energy cosmic γ rays. (auth)

9051 ON THE CHARGE RATIO OF COSMIC-RAY MUONS AT SEA LEVEL. P. V. Ramana Murthy (Tata Inst. of Fundamental Research, Bombay). Nuovo Cimento (10), 30: 762-71(Nov. 1, 1963).

An attempt is made to explain the charge (+/–) ratio of cosmic muons at energies ≳40 Bev observed at sea level on the basis of the production of pions in the normally considered inelastic interactions of nucleons and also through the decay of isobars produced in the quasielastic scattering of high-energy nucleons. (auth)

9052 COSMIC-RAY INTENSITY AT GREAT DEPTHS AND NEUTRINO EXPERIMENTS. M. G. K. Menon (Tata Inst. of Fundamental Research, Bombay), P. V. Ramana Murthy, B. V. Sreekantan, and S. Miyake. Nuovo Cimento (10), 30: 1208-19(Dec. 1, 1963).

Measurements on cosmic-ray intensities deep under-

ground up to depths of 8,400 m w.e. are presented. On the basis of these observations it is suggested that, for investigations on naturally occurring neutrinos, there are great advantages to be gained by performing the experiments at considerable depths—around 9,000 ft—below the earth's surface, essentially because of the very low background that is encountered at such depths. Some features relevant to neutrino physics that emerge from the measurements already made and the design of future experiments to detect cosmic ray produced and extra terrestrial neutrinos are discussed. (auth)

9053 HIGH-ENERGY INELASTIC COLLISIONS AND MULTILINKED MODEL. K. Kobayakawa (Univ. of North Carolina, Chapel Hill). Nuovo Cimento (10), 30: 1560-2 (Dec. 16, 1963).

A general multilinked model for cosmic jet showers in which the colliding particles interact with each other through a chain of fireballs linked by spinless bosons, is discussed. It is assumed that the square of the four-momentum transfer of each linked boson has the same distribution and that the fireball mass is independent of the square of the total energy. (C.E.S.)

9054 COSMIC-RAY HYDROGEN AND HELIUM NUCLEI DURING A SOLAR QUIET TIME IN JULY 1961. C. E. Fichtel (Goddard Space Flight Center, Greenbelt, Md.), D. E. Guss, G. R. Stevenson, and C. J. Waddington. Phys. Rev., 133: B818-27(Feb. 10, 1964).

The energy spectra of low-energy primary cosmic-ray hydrogen and helium nuclei were determined from nuclear emulsions flown on a high-altitude balloon. The flight was preceded by a period of three months of low solar and geophysical activity. The results indicated that the differential spectrum of hydrogen nuclei in this low-energy interval decreased toward low energies and did not exhibit the sharp rise found with counters in 1960 and 1961 by other experimenters. The low-energy differential spectrum and integral flux value for helium nuclei were found to be intermediate between those typical of solar minimum and solar maximum and are consistent with a modulation mechanism that yields the same rigidity spectrum for a given intensity both before and after solar maximum. Various modulation models of galactic cosmic rays are examined, and it is concluded that none of them seem to be entirely adequate. (auth)

9055 SOME REMARKS CONCERNING THE ENERGY DEPENDENCE OF THE INTENSITIES OF NUCLEI OF HELIUM-3, LITHIUM, BERYLLIUM, AND BORON IN THE GALACTIC COSMIC RADIATION. G. D. Badhwar and R. R. Daniel (Tata Inst. of Fundamental Research, Colaba, India). Progr. Theoret. Phys. (Kyoto), 30: 615-26(Nov. 1963).

Available experimental data on the energy dependence of the production cross sections of some favorable light nuclei from spallation reactions of protons with typical cosmic-ray nuclei were examined. The analysis focuses attention on the necessity of determining accurately cross sections for the production of isotopes of light nuclei from various targets at low bombarding energies; this is necessary for the proper understanding and interpretation of the primary cosmic radiation. The calculations show that in the galactic cosmic radiation the deuterons produced from spallations constitute only a very small proportion of singly charged particles, whereas the proportion of He^3 among doubly charged particles is large enough to be detected experimentally, the production rate of He^3 is energy dependent and can be employed to deduce information on the history of the radiation, and the amount of matter traversed by the radiation during the time of its acceleration from 20 to 100 Mev/n is much less than 2.5 g/cm^2 of hydrogen. 46 references. (auth)

9056 ACCELERATION BY RADIATION AND THE GENERATION OF FAST PARTICLES UNDER COSMIC CONDITIONS. V. N. Tsytovich (Lebedev Inst. of Physics, Moscow). Soviet Astron.-AJ (English Transl.), 7: 471-9 (Jan.-Feb. 1964).

The radiation mechanism of acceleration is compared with other mechanisms. Radiation acceleration may play an important part in the dynamics of certain cosmic objects. (auth)

9057 BEHAVIOR OF THE COSMIC-RAY ENERGY SPECTRUM AT HIGH ENERGIES. V. M. Byakov. Soviet Astron.-AJ (English Transl.), 7: 480-4(Jan.-Feb. 1964).

The increase of the exponent γ of the energy spectrum $f(E)dE \sim dE/E^{\gamma}$ of primary cosmic radiation in the 10^{15}-ev energy region is associated with the setting in of anisotropy in the scattering of cosmic particles with these energies on nonuniformities of the galactic magnetic field. It is shown that in the absence of acceleration in the motion of cosmic rays in interstellar space, the exponent γ should, in accordance with observations, increase by ≈ 1. (auth)

9058 THE COSMIC NEUTRINO. Donald Francis Ryan. Thesis, Washington, D. C. Catholic Univ. of America, 1963. 68p.

The detection of a signal associated with high-energy cosmic neutrinos, originating for the most part in pi-meson decays ($\pi \rightarrow \mu + \nu$), in the earth's atmosphere was sought. A large liquid scintillator was used as the detector. The interaction looked for was the creation of a mu-meson in the target region of the detector. $\bar{\nu} + p^+ \rightarrow n + \mu^+$, $\nu + n \rightarrow p^+ + \mu^-$. The earth was used as a shield against cosmic-ray background-induced events, and signals attributable to a neutrino coming up through the earth were of main interest. The events were recorded on a 35 mm camera and a dual beam oscilloscope. The scope and the camera were triggered whenever the electronic requirements on an event were satisfied in the detector. The films were analyzed for neutrino-like events as well as for cosmic ray background events. It is believed that the experiment produced a positive result. A signal rate of approximately 0.035 ± 0.006/hr was determined, which seems to be independent of any known observable cosmic ray phenomena. (Dissertation Abstr.)

9059 PROISKHOZHDENIE KOSMICHESKIKH LUCHEI. (The Origin of Cosmic Rays). V. L. Ginzburg and S. I. Syrovatskii. Moscow, Publishing House of the Academy of Sciences, 1963. 384p.

The components and energy spectra of primary cosmic radiation, synchrotron cosmic radiation, the motion of cosmic radiation in interstellar space, the origin of cosmic radiation, and quantitative galactic theories on their origin are discussed. A bibliography of 412 references is included. (C.E.S.)

Criticality Studies

9060 (AHSB(S)R-56) THE IDENTIFICATION OF CRITERIA FOR CRITICALITY ASSESSMENT. G. M. Jordan (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England). 1963. 11p.

The basic principles applicable to the assessment of accidental criticality hazard to process and storage facilities in which significant amounts of fissile materials are handled are examined. The differences in technique

for pre-commissioning and post-commissioning assessment are outlined; and the need for close collaboration between designer, operator, and assessor is emphasized. Commonly-encountered process operations and contingencies are presented in tabular form, each operation or contingency being entered below the basic criticality parameter affected. (auth)

9061 PARAMETRIC SURVEY OF CRITICAL SIZES. William H. Roach (Los Alamos Scientific Lab., N. Mex.). Progr. Nucl. Energy, Ser. IV, 5: 505-33(1963).

A survey of critical sizes of simple geometric shapes is presented from experiment and calculation. An extension to computational surveys is given from the DSN computing scheme with a standard set of multigroup input parameters. 47 references. (R.E.U.)

Direct Energy Conversion

Refer also to abstract 8700.

9062 (63-RL-3506E) STABILITY OF GAS FLOW IN AN MHD GENERATOR. S. Tamor (General Electric Co. Research Lab., Schenectady, N. Y.). Nov. 1963. 17p.

The stability of the flowing gas and current system in a magnetohydrodynamic generator is examined. In particular, perturbations in which the density of the driven gas is changed are considered. Such perturbations cause a change in the Hall current, which in turn reacts upon the gas via the $J \times B$ force. It is found that an unstable regime does exist and that this can indeed be a serious problem. The destabilizing force, however, depends mainly upon the component of current parallel to the gas flow and can hence be minimized by segmenting the electrodes. (auth)

9063 (AD-425081) BASIC RESEARCH IN THERMIONIC CONVERTERS. Final Report, May 1, 1962–October 31, 1963. James R. Fendley, Jr., and Karl G. Hernqvist (Radio Corp. of America. RCA Labs., Princeton, N. J.). Contract NONR-3826(00)FBM. 17p.

Apparatus and measurement techniques for studies of the effects of adding noble gases to operating cesium vapor thermionic converters are described. Experimental results on the effect of adding helium and argon at pressures up to several tens of torr are given. The thermionic converter operating in the low-temperature arc mode is relatively insensitive to noble gas additives. The observed effects of gas dosing are small and can be summarized as follows: The discharge becomes more stable and the glow region in the interelectrode space becomes more uniformly distributed. The electron transport properties of the diode are adversely affected at high current densities and large electrode spacings. The output voltage at low current levels increases upon introduction of noble gases. Theoretical interpretations of these results are described. (auth)

9064 (GA-4012) HIGH-TEMPERATURE VAPOR-FILLED THERMIONIC CONVERTER. Final Technical Report, March 15, 1962 through September 15, 1963. R. Skoff (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Contract AF33(657)-8563. 104p. (RTD-TDR-63-4190)

The operating characteristics of plasma converters utilizing bare uranium–zirconium carbide as the emitting surface were determined as a function of operational lifetime. The emitter design was cylindrical in a size representative of that expected in a space thermionic reactor. The electrode spacing varied from 0.040 to 0.012 in. The converter performance was evaluated as a function of lifetime and, the failure mechanism on those converters that no longer demonstrated useful power levels was determined. An operational lifetime of 3,000 hr was considered a reasonable goal. Electrically heated, as opposed to fission-heated, converters were selected as the most economical method of fulfilling the objectives. Six converters were operated for over 6,000 hr at power levels of 10 to 40 watts (1 to 4 watts/cm^2) on a continuous-performance basis. A maximum power density of 6.8 watts/cm^2 was observed at an emitter temperature of 2,245°K. The optimum cesium-reservoir temperature for all converters tested occurred at 605 to 630°K. Collector-temperature optimization was not clearly established within the temperature range investigated. The performance of bare-carbide converters increases almost exponentially with increasing emitter temperature. Performance observations were made in the emitter-temperature range 1900 to 2400°K. Five of the six converters failed during operation owing to envelope leakage, resulting in the complete loss of cesium to the surrounding vacuum chamber. Despite the depletion of uranium from the bulk of the emitter, vacuum-emission currents measured pre- and post-test were nearly identical in magnitude. Both uranium and zirconium, evaporated from the emitter surface, were deposited on the collector. (auth)

9065 (MND-3143-1) INVESTIGATION OF GAS PRESSURE BUILDUP IN THERMOELECTRIC SNAP GENERATORS. W. A. McDonald and J. McGrew (Martin-Marietta Corp. Aerospace Div., Baltimore). Jan. 1964. Contract AT(30-1)-3143. 43p.

The program for investigating gas pressure buildup in thermoelectric generators was initiated in February 1963 and continued through December 1963. The program objectives were to determine the source(s) of internal gas pressure increase in SNAP thermoelectric generators, establish methods of alleviating or eliminating the condition, and conduct a proof-of-principle test on an electrically heated 60-watt thermoelectric SNAP generator to determine the effectiveness of the procedures developed to control or eliminate the condition. The gas pressure increase in the generators that were initially filled with dry inert gas results from decomposition of the phenol-formaldehyde resin that is used as a binder in the Min-K 1301 thermal insulation and desorption of atmospheric gases and water vapor that adsorb on the surface of the insulation. The degree of gas release in both cases was determined to be temperature and pressure dependent. The recommended procedure to control gas pressure buildup for all future generators is: (1) precondition the Min-K by burning off the phenolic resin binder; (2) vacuum outgas the insulation at a temperature above its maximum operating temperature; and (3) install a gas getter (zirconium) to absorb any gases that may be released during subsequent generator operation. The complete recommended procedure to control this pressure buildup could not be employed in the 60-watt thermoelectric SNAP generator test since the generator had been previously constructed and assembled using Min-K that had not been preconditioned by outgassing. Therefore, a modified outgassing procedure was established for the generator when the test was initiated. The procedure, in essence, specified that the generator be maintained on continuous evacuation while the thermoelement hot junction temperature was slowly increased to ~525°F, and that the generator be subjected to frequent rapid evacuations and gas changes as the temperature was increased to 960°F. (Lead telluride thermoelements begin to sublime in a vacuum at elevated temperatures in the 950 to 1000°F range.) An amount of 2,143 grams of zirconium sponge were inserted in the hottest region of the generator to re-

act with getterable gases that remained after the outgassing and evacuation procedure. The 60-watt electrically heated SNAP generator was then maintained on a stability test for two months. The generator internal gas fill pressure remained essentially constant throughout the period, demonstrating that the recommended control procedure will alleviate the internal gas pressure buildup condition. (auth)

9066 (MND-P-2975) CHARACTERISTICS OF FUEL COMPOUNDS AND ENCAPSULATION MATERIALS IN RADIOISOTOPE HEAT SOURCES. (Martin-Marietta Corp. Aerospace Div., Baltimore). Apr. 17, 1963. Contract AT(30-1)-2345. 19p.

The properties of radioisotope fuel compounds and fuel capsule materials which are pertinent to the design and operation of radioisotope heat sources are outlined. These properties are grouped into the following categories: intrinsic, extrinsic, and compatibility. The properties of strontium titanate as the fuel and Hastelloy C as the capsule material are evaluated. (D.L.C.)

9067 (SC-4960(RR)) THE HYPERSONIC PLASMA CONVERTER. [PART] I. K. J. Touryan (Sandia Lab., Albuquerque, N. Mex.). Jan. 1964. Contract [AT(29-1)-789]. 38p.

Theoretical and experimental analyses describing the operation of the hypersonic plasma generator known as ASP (Aerodynamic Supply of Power) are presented. Previous investigations are reviewed, corrected, and summarized. Additional information is introduced to bring the present status of the generator up to date. (auth)

9068 (SC-DC-3530) ELECTRON-VOLTAIC CELL STUDY. Wendall C. Robison and Marvin D. Nelson (Nebraska. Univ., Lincoln). [1963]. For Sandia Corp., Albuquerque, N. Mex. Contract AT(29-1)-789. 58p.

The properties of Si, GaAs, Ge, and possible beta sources were considered, together with radiation damage to the three materials. Additionally, the characteristics of p-n junction cells under beta activity were derived, and the characteristics of GaAs and Si cells were obtained experimentally. The results indicate that a nuclear battery using GaAs or n-p Si cells with Pm^{147} as the source would operate for 5 to 10 yr with very little radiation damage. Cell characteristics for a given source activity were calculated. 66 references. (D.C.W.)

9069 (SC-DC-3553(p.91-102)) SAFETY OF ISOTOPIC SNAP GENERATORS. W. Hagis and D. G. Harvey (Martin-Marietta Corp. Aerospace Div., Baltimore).

The SNAP-3 and TRANSIT-4A generators are used in illustration of safety requirements. The factors considered are the type and fuel inventory of the isotope selected, the method of placing the power system into orbit and the replacement rate, the mission, altitude, and orbital inclination of the satellite, and the period in which the systems are to be used and the technology involved in experiments performed during this time. (R.E.U.)

9070 A THEORETICAL ANALYSIS OF THE THERMODYNAMICS OF THE STRIATED LAYER MAGNETOHYDRODYNAMIC SYSTEM. N. Fraidenraich, I. A. McGrath, S. A. Medin, and M. W. Thring (Univ. of Sheffield, Eng.). Brit. J. Appl. Phys., 15: 13-27(Jan. 1964).

The thermodynamic scheme of an electrical power station with an open-cycle magnetohydrodynamic generator is considered. To improve the electrical conductivity of the flow, short pulses of fuel and oxygen are injected at the exit of the combustion chamber. The flame temperatures of fuel, with air preheated to 1000°K, are 2670 and 2700°K at 5 and 10 atm, respectively. The combustion products are expanded in the generator up to the stagnation pressure of 1.2 atm. The parameters and structure of the flow and the efficiency of the generator are calculated for different isentropic efficiencies of the magnetohydrodynamic generator. The overall efficiency of the power station was analyzed taking into account the compressor work, the power input for the magnetic field and the oxygen generation, the heat losses in heat exchangers and the efficiency of the steam cycle. An impulse type magnetohydrodynamic generator is proposed. The quasi-one-dimensional flow equations are presented and the solution of the problem is obtained. It is shown that it is possible to obtain high overall efficiencies of the power station with reasonable dimensions of the magnetohydrodynamic duct. (auth)

9071 ON SPACE CHARGE NEUTRALIZATION BY POSITIVE IONS IN LOW-PRESSURE THERMIONIC CONVERTERS. L. Brandus and I. Popescu (Institutul de Fizicõ, Academia R.P.R., Bucharest). Brit. J. Appl. Phys. 15: 85-8(Jan. 1964).

The effect of a uniform distribution of ions on the space charge between the electrodes of a thermionic converter under collision-free conditions is evaluated. It is shown that the quantity $\gamma = e(kT/m)^{1/2}n_i/j$, where n_i is the ion concentration and j is the electric current density, must exceed at least 0.1 for the space charge to be appreciably reduced. (auth)

9072 PRELIMINARY EXPERIMENT ON MHD POWER GENERATION USING ARGON PLASMA. Kozo Fushimi, Takashi Kutsuwada, and Shigeru Ikeda. Denki Shikensho Iho, 27: 482-6(July 1963).

A small-scale experiment on MHD power generation using argon plasma heated by an electric arc is described. The power-generating channel of the equipment is composed of graphite electrodes, and the alumina wall has a geometry of 1 × 1 cm in cross section and 2 cm in length. The temperature and velocity of the working fluid seeded with potassium carbonate are about 2,000°K and 150 m/sec. The maximum power, no-load voltage, and short-circuit current generated by this equipment are about 20 mw, 1.5v, and 95 mamp. From the experimental results it is concluded that a MHD generator even for experimental use has to generate no-load voltages many times higher than the potential drops that occur in the boundary layers between the plasma and the electrodes, and that in the generator for short duration experiments, graphite may be used as the electrode material, and alumina as the wall material. (auth)

9073 EFFECT OF BOUNDARY LAYER AT MHD POWER GENERATOR. Takuya Honma and Masahiko Tamura. Denki Shikensho Iho, 27: 487-90(July 1963).

In MHD power generation, the depth of boundary layer at the wall of the duct and the distribution of the velocity and temperature of the working fluid are estimated. The results are applied to a design of a MHD power generator on condition that the main fluid velocity is 800 m/sec, the temperature 2500°C, and a combustion gas and a copper wall of 1 cm depth cooled down to 50°C with water are used. (auth)

9074 APPLICABILITY OF NON-EQUILIBRIUM PLASMA TO MHD POWER GENERATION. Kozo Fushimi and Takuya Honma. Denki Shikensho Iho, 27: 496-501 (July 1963).

The relaxation phenomena of plasma in which the gas temperature is about 1000°K and the electron temperature is 10 times as high and effects of the phenomena on MHD power generation are theoretically investigated. (auth)

9075 CONDUCTIVITY OF NON-EQUILIBRIUM PLASMA IN MHD POWER GENERATION. Takuya Honma. Denki Shikensho Iho, 27: 502-7(July 1963).

The time variation of the electron density, from direct collision ionization, in a plasma is estimated, and an application of the result to MHD power generation is discussed. (auth)

9076 TEST-RUNNING OF AN EXPERIMENTAL MHD GENERATOR MARK I. Fusao Mori, Kozo Fushimi, Takashi Kutsuwada, and Shigeru Ikeda. Denki Shikensho Iho, 27: 515-20(July 1963).

Construction features of an experimental MHD generator and the results of its test are described. The generator derives its energy from the combustion of propane, methyl alcohol in which KOH is desolved, and oxygen, and has a generating duct of constant area type, 2 × 7 × 19 cm which is operated in a magnetic field of 17 kgauss. (auth)

9077 ONSET OF BREAKDOWN AT VOLTAGES BELOW IONIZATION POTENTIAL IN HIGH-PRESSURE THERMIONIC DIODES. R. Forman (Union Carbide Corp., Parma, Ohio). J. Appl. Phys., 35: 261-4(Feb. 1964).

Early breakdown effects were measured in relatively high-pressure thermionic diodes under given conditions of pressure and anode spacing. Apparent breakdown conditions are obtained at anode voltages considerably lower than the ionization potential of the gas. Measurements on xenon- and mercury-filled thermionic diodes, under space-charge conditions of operation, are presented that show that this breakdown voltage seems to be associated with the first excited state of the gas. Experimentally, early ignition occurs in diodes with a fixed cathode–anode spacing in a limited pressure range only. A theoretical explanation for this behavior is based on the model that, in the limited pressure range, electrons traversing the cathode–anode space can pick up almost all the energy of the applied voltage. In addition, data are presented showing that early breakdown in an inert gas-filled diode can occur at voltages much lower than the first excited state. This was accomplished in thermionic diodes exposed to the radiation of a nuclear reactor. A qualitative explanation for this behavior is proposed. (auth)

9078 COAL-FIRED MHD STEAM PLANTS— PRESENT AND FUTURE. Edward V. Somers (Westinghouse Electric Corp., Pittsburgh). Proc. Am. Power Conf., 25: 83-92(1963).

A survey is presented of the problems involved in designing economical coal-fired magnetohydrodynamic (MHD) d-c power generators. These problems are seed cost, generator structural cost, magnet cost, and oxidant cost. Satisfactory progress is reported in most of the problems, and the present status and future prospects of coal-fired MHD generators are summarized. A heat rate of 6200 Btu/kwh is obtained for the MHD–steam combined cycle as compared with 8200 Btu/kwh for the steam cycle alone. Estimated costs of coal-fired MHD stations and conventional stations are tabulated. (D.L.C.)

9079 NUCLEAR MAGNETOHYDROELECTRIC GENERATOR. (to United Aircraft Corp.). French Patent 1,295,806. May 2, 1962. Priority date July 22, 1960, United States.

Nuclear magnetohydroelectric generators are known in which a highly ionized fluid coming from a nuclear reactor passes through a magnetic field, so that this fluid flow, forming an electric conductor, cuts the lines of force of the magnetic field and generates in this way electric energy. The efficiency of this energy generation is limited by the maximum admissible coolant temperature within the reactor. In order to pass beyond these limits, the temperature of the working fluid is increased by the fission of a material forming a constituent of this fluid. The fissile material is brought into the critical state in a special region of the working circuit in immediate proximity of the region of generation of electric energy. According to a first embodiment, a tubular reaction chamber is provided enclosed over a portion of its length by a reflector that induces the criticality of the fluid system within the portion while the magnetic field and the electrodes of the electric generator occupy a portion of the tube length that is slightly shifted into a down stream direction with respect to the reflector region. According to another embodiment an annular common chamber for nuclear reaction and electric generation is provided, through which the ionized fluid passes in a vortex-like flow scheme. (IIB)

Elementary Particles and Radiations

Refer also to abstracts 8958, 8970, 9229, 9230, 9235, 9236, 9245, 9368, and 9385.

9080 (BNL-7588) CORRECTIONS TO π-e SCATTERING: NUMERICAL INTEGRATIONS. Philip B. Allen and Morton M. Sternheim (Brookhaven National Lab., Upton, N. Y.). Sept. 24, 1963. Contract [AT(30-2)-Gen-16]. 12p.

The radiative corrections to π-e scattering calculated by Kahane involve difficult integrations over the momenta of hard photons. Some of the integrals were evaluated numerically; results are compatible with Kahane's estimates of the errors in his approximate analytic results. (auth)

9081 (LNF-63/40) KINEMATIC TABLES FOR PHOTOPRODUCTION OF TWO-BODY SYSTEM. Note No. 202. R. S. Jones (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). May 30, 1963. 51p.

The kinematics for the photoproduction ($\gamma + p \rightarrow p + x$) in hydrogen of a compound system x that decays into two photons or two pions are tabulated. Separate tables are given for the pion and photon decay modes, for incident photon energies <2000 Mev, and for masses of x between 300 and 800 Mev. (auth)

9082 (LNF-63/66) POSSIBLE DETERMINATION OF THE CHARACTER OF THE HIGHER RESONANCES IN PION-PHOTOPRODUCTION AND PROTON COMPTON EFFECT BY USING POLARIZED γ RAYS. Note No. 216. A. Verganelakis (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Oct. 31, 1963. 12p.

An analysis is presented showing that second and third resonances in pion photoproduction and proton Compton effect could probably be studied by using polarized photons. (D.C.W.)

9083 (LNF-63/77) INVARIANT PHASE-SPACE INTEGRAL FOR A SYSTEM OF n-PARTICLES. Note No. 223. G. Penso and V. Silvestrini (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Dec. 9, 1963. 8p.

The phase-space integral for a system of n-particles is expressed in terms of the integral for n-1 particles. The formula is used for the explicit calculation of the phase-space integral for 3 and 4 particles. A formula is also given for the calculation of the effective-mass spectrum of k particles out of n. (auth)

9084 (NP-13484) PROTON-NUCLEON INTERACTIONS AT 14 Gev IN NUCLEAR EMULSION. M. Csejthey-Barth (Brussels. Universite). Oct. 1963. 17p.

Interactions of 14-Bev protons with free and quasi-free nucleons were studied in nuclear emulsion. The elastic cross-section for proton–free proton collision is estimated to be (11 ± 4) mb. The numbers of protons, charged mesons (π) and mesons (K) per inelastic interaction were found to be 1.24 ± 0.09, 2.53 ± 0.19, and 0.30 ± 0.06, respectively. The center-of-mass system angular distributions and the mean values of the center-of-mass system momenta for charged secondaries are given and compared with the results at other energies. (auth)

9085 (NP-13532) A MODEL FOR MULTIPLE MESON PRODUCTION IN π-p INTERACTIONS AS AN APPLICATION OF THE REGGE POLES HYPOTHESIS. E. C. Mihul and D. B. Ion (Academia R. P. R. Institutul de Fizică Atomică, Bucharest). Oct. 1963. 8p.

The Regge method is applied to the multiple pion production process in the interaction $\pi^- + p$. Differential cross-sections are obtained, in vacuum pole approximation, for an even number of produced pions. Since the Regge method corresponds to high energies, where multiple production is prevalent, the results allow an experimental proof of the validity of this method. From the distributions obtained, superposed on those already known for an odd number of pions, the proton distribution can be obtained for every number (odd or even) of created pions. (auth)

9086 (TID-20011) A POSSIBLE EXPLANATION OF THE OBSERVED ASYMMETRY IN ρ^0 DECAY. Philippe Eberhard (California. Univ., Berkeley. Lawrence Radiation Lab.) and Morris Pripstein (Illinois. Univ., Urbana). [1963]. Contract AT(11-1)-1195. 10p.

It is proposed that the forward-backward asymmetry in the meson (ρ^0) decay distribution for the interaction $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ can be attributed to the production of the N^+_{33} resonance in the interaction, the production being greater in the $(\pi^+ - n)$ system than in the $(\pi^- - n)$ system. Evidence consistent with the conjecture is cited, and tests are suggested. (D.C.W.)

9087 (UCRL-11096) A NUMERICAL STUDY OF THE REGGE PARAMETERS IN POTENTIAL SCATTERING (thesis). Akbar Ahmadzadeh (California. Univ., Berkeley Lawrence Radiation Lab.). Oct. 30, 1963. Contract W-7405-eng-48. 155p.

The threshold and asymptotic behavior of the Regge parameters is discussed, and some examples given. It is shown that the position and residue of the first trajectory of a single attractive Yukawa potential satisfy the dispersion relation expected when there are no intersections with other trajectories. An example is given of a repulsive Yukawa potential where the position of the pole does not satisfy such a dispersion relation. The Regge parameters for the first few trajectories of a single attractive Yukawa potential are given in the form of figures. Examples are given of a simple superposition of attractive and repulsive Yukawa potentials for which the trajectories are similar to the relativistic case. By modifying the background integral, the Regge formula is rewritten to include the Born term and to make the background integral less significant. The Khuri series for the partial-wave amplitude was modified to explicitly single out the Born term. In deriving this modified series it is shown that one needs weaker asymptotic conditions on the partial-wave amplitude than those used by Khuri. The convergence of this series was investigated for the case of a single Yukawa potential. It is found that the modified series converges considerably faster than the Khuri series. (auth)

9088 (UCRL-11113) CONSTRUCTION OF INVARIANT SCALAR AMPLITUDES WITHOUT KINEMATICAL SINGULARITIES FOR ARBITRARY-SPIN NONZERO-MASS TWO-BODY SCATTERING PROCESSES. David N. Williams (California. Univ., Berkeley. Lawrence Radiation Lab.). Sept. 9, 1963. Contract W-7405-eng-48. 99p.

An explicit decomposition of the S-matrix into invariant scalar amplitudes without kinematical singularities is presented for the case of two-particle to two-particle transition amplitudes for particles with arbitrary spins and arbitrary, nonzero masses. It is concluded that the conditions for a holomorphic decomposition are satisfied in analytic S-matrix theory. (D.C.W.)

9089 (UR-875-11) PROCEEDINGS OF SEMINAR ON UNIFIED THEORIES OF ELEMENTARY PARTICLES, JULY 1963. D. Lurie and N. Mukunda, eds. (Rochester, N. Y. Univ.). Contract AT(30-1)-875. 429p.

Separate abstracts were prepared for seventeen of the nineteen papers included. Two papers on self-consistent bound states of strongly interacting particles and on broken symmetry and zero mass bosons were previously abstracted in NSA. (D.C.W.)

For abstracts of individual papers see: 9090, 9091, 9092, 9093, 9094, 9095, 9096, 9097, 9098, 9099, 9100, 9101, 9102, 9213, 9214, 9215, and 9216.

9090 (UR-875-11(p.1-26)) VECTOR MESONS AS BOUND STATES. I. Bialynicki-Birula (Warsaw. Univ. Inst. of Theoretical Physics).

It is shown that within the framework of the conventional field theory, containing only a spinor field, bosons can be obtained as bound states of fermion-antifermion pairs. The fermions are taken to be electrons–the bound states, photons. Nucleons and vector mesons can probably be considered in the same context. (D.C.W.)

9091 (UR-875-11(p.27-65)) ELECTRON AS AN ENERGY GAP IN A CUTOFF FREE APPROXIMATION. Kenneth Johnson (Massachusetts Inst. of Tech., Cambridge).

An approximation scheme that, in contrast to perturbation theory, preserves the asymptotic behavior of all Green's functions is described. (D.C.W.)

9092 (UR-875-11(p.66-82)) SOME PROBLEMS IN THE THEORY OF THE SYMMETRIES OF STRONG INTERACTIONS. [PART] I. R. Cutkosky (Carnegie Inst. of Tech., Pittsburgh).

The possibility that equal masses for particles of the same parity and spin imply symmetrical couplings only is examined. A simple model assuming equally massive vector mesons and antisymmetric vertex functions is considered. (D.C.W.)

9093 (UR-875-11(p.83-101)) SOME PROBLEMS IN THE THEORY OF THE SYMMETRIES OF STRONG INTERACTIONS. [PART] II. R. Cutkosky (Carnegie Inst. of Tech., Pittsburgh).

The possibility of using a solution of the mass and coupling constant functions that represent the energies of bound states when the masses are equal and the coupling constants obey some group relations to obtain nearby solutions with broken symmetries is examined. (D.C.W.)

9094 (UR-875-11(p.102-24)) STRONG-COUPLING SOLUTIONS OF VECTOR-COUPLED FIELDS. K. A. Johnson (Massachusetts Inst. of Tech., Cambridge).

The possibility of starting from a theory like electrodynamics and finding solutions such that the vector field ef-

fectively shows a mass and there are no longer any long range forces between the particles is investigated. A simple model containing one kind of nucleon and antinucleon is considered. (D.C.W.)

9095 (UR-875-11(p.125-59)) BROKEN SYMMETRIES AND UNCONVENTIONAL SOLUTIONS OF STANDARD FIELD THEORY. A. Klein (Pennsylvania. Univ., Philadelphia).

A connection is established, in a certain class of field theories, between the concept of broken symmetry or degenerate vacuum and the necessary occurrence in theories with this property of massless particles. (D.C.W.)

9096 (UR-875-11(p.160-82)) INTERACTION AMONG GAUGE VECTOR FIELDS. R. Arnowitt (Northeastern Univ., Boston).

The coupling of massless charged vector bosons to the electromagnetic field is investigated. Conventional electromagnetic couplings are considered. It seems that, at least for spin = 1, no physically interesting allowed couplings can arise. The effects of the gage invariance in the boson fields receive close attention. (D.C.W.)

9097 (UR-875-11(p.183-99)) CONSIDERATIONS ON THE SELF-CONSISTENT BREAKDOWN OF SYMMETRIES. Y. Nambu (Chicago. Univ. Enrico Fermi Inst. for Nuclear Studies and Chicago. Univ.).

The breakdown of symmetries in large macroscopic media, finite systems, and field theory, particularly field theory models with chiral symmetry, is discussed. Appropriate examples are considered. (D.C.W.)

9098 (UR-875-11(p.237-50)) BROKEN SYMMETRIES. R. [E.] Behrends (Yeshiva Univ., New York).

It is noted that except for the spin-parity and isotopic spin assignments of the 1405 and 1530-Mev resonances, respectively, the simple second-rank Lie G_2 is compatible with present experimental knowledge of the hadron spectra (strongly interacting particles). The predictions of G_2 and SU_3 are presented, and decay modes and a symmetry-breaking interaction, leading to mass splitting are considered. (D.C.W.)

9099 (UR-875-11(p.294-320)) MASS DIFFERENCES OF PARTICLES. H. Miyazawa (Tokyo Univ.).

A method for calculating mass differences of particles in the S-matrix theory is presented. Unconventional solutions of the mass equation and mass splitting of various particles are also considered. (D.C.W.)

9100 (UR-875-11(p.321-44)) NONLINEAR SPINOR MODEL. H. P. Duerr (California. Univ., Berkeley and Max-Planck-Institut für Physik und Astrophysik, Munich).

The formulation of the theory is discussed. The approximations made in calculations particularly are considered. (D.C.W.)

9101 (UR-875-11(p.375-89)) UNSUBTRACTED DISPERSION RELATIONS FOR WEAK INTERACTIONS AND THE GOLDBERGER-TREIMAN RELATION. K. Nishijima (Illinois. Univ., Urbana).

The decay $\pi \rightarrow \mu + \nu$ was studied under the assumption that all weak decay amplitudes satisfy unsubtracted dispersion relations. In considering the $\pi \rightarrow \mu + \nu$ decay amplitude Goldberger and Gell obtained the same result (Goldberger-Treiman relation) although their assumptions on unsubtracted dispersion relations were independent. The basis of this occurrence and the eigenvalue restrictions coming from the assumed unsubtracted dispersion relation are discussed. (D.C.W.)

9102 (UR-875-11(p.390-410)) BROKEN SYMMETRIES IN TERMS OF INEQUIVALENT REPRESENTATIONS. Y. Takahashi (Dublin Inst. for Advanced Studies).

The inequivalent representations that arise when the normalization volume becomes infinite are considered. A simple physical condition by which a particular inequivalent representation is singled out to treat a broken symmetry is proposed. (D.C.W.)

9103 POTENTIAL SCATTERING AT HIGH ENERGIES. Walter Hunziker (Eidgenössische Technische Hochschule, Zürich). Helv. Phys. Acta, 36: 838-56 (1963).

An asymptotic expansion of the scattering amplitude for Schrödinger- and Dirac-potential scattering in inverse powers of the wave number k was developed. In both cases the first few coefficients of this expansion are given explicitly in terms of the potential V(x). In order to simplify the proofs it was assumed that V(x) is infinitely often differentiable and vanishes with all its derivatives faster than any inverse power of x as $x \rightarrow \infty$. (auth)

9104 ON QUANTUM THEORY OF RADIATION. A. Peterman (CERN, Geneva). Helv. Phys. Acta, 36: 942-4(1963).

The fourth-order magnetic moment of the meson (μ) and related problems in atomic level shifts are discussed. (M.C.G.)

9105 INTEGRAL OPERATORS IN THE THEORY OF SCATTERING. B. Misra, D. Speiser, and G. Targonski (Université, Geneva). Helv. Phys. Acta, 36: 963-80(1963).

Von Neumann's work on the integral representation of self-adjoint operators was extended. It is shown that the S-operator is the sum of the identity transformation and a Carleman integral operator on the energy shell if and only if the total scattering cross section is finite. (auth)

9106 EXPERIMENTAL INVESTIGATION OF THE MASS-MOMENTUM RELATION OF ELECTRONS. V. Meyer, W. Reichart, H. H. Staub, H. Winkler, F. Zamboni, and W. Zych (Universität, Zürich). Helv. Phys. Acta, 36: 981-92(1963). (In German)

An experiment is described by which the mass-momentum relation for the electron was verified at values of β from 0.987 to 0.990. A method was used by which electrons and non relativistic particles, protons, move on identical orbits in a cylindrical electric field thus avoiding the difficulties encountered is using electrostatic deflectors as absolute measuring devices. From the measured data the expression, $Y = (m/m_0)/(\sqrt{1 + p^2/m_0^2c^2})$, which is unity for the Lorentz relation, was computed. The averaged result deviated from unity by 0.00037 ± 0.00036 thereby verifying the validity of the Lorentz relation to this accuracy. (auth)

9107 ON THE BEHAVIOR OF REAL AND VIRTUAL AMPLITUDE PARTS IN ELASTIC p-p SCATTERING AT HIGH ENERGIES. S. A. Azimov, G. G. Arushanov, and A. A. Yuldashev (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 21-2(1963). (In Russian)

The real and virtual amplitudes in elastic p-p scattering were calculated using an F(t) (where t is the square of transmitted 4-momentum) and l(t) a constantly decreasing function determined by A. N. Diddens et al. (Phys. Rev. Letters 9, 111, 1962). The results of calculations for $s/2m^2 = 20$, where s is the total energy of scattered particles (center-of-inertia) and m^2 is a constant, are plotted. The magnitude $\mathrm{Im}F(s,t)/\sigma_{tot}$ decreases from one at $t = 0$ to 0 at $t = -1$. The $\mathrm{Re}F(s,t)/\sigma_{tot}$ has a negative value and reaches a maximum (absolute) approximately at $t = -0.2(\mathrm{Bev/c})^2$. (R.V.J.)

9108 PHENOMENOLOGICAL STUDY OF ELASTIC PHOTON SCATTERING ON PROTONS. S. A. Azimov and

G. G. Arushanov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 4, 79-85(1963). (In Russian)

A phenomenological study was made of $\gamma + p \rightarrow \gamma' + p'$ process at 200 to 800 Mev. The investigation considered the amplitudes related to the resonance state $(3/2, 3/2^+)$ and $(1/2, 3/2^-)$. The angular and energy functions and proton polarization at $\theta = \pi/2$ were considered. The results showed that in contrast to publishing data, forward scattering becomes predominant at ~250 Mev. (R.V.J.)

9109 ATOMIC CAPTURE OF μ^--MESONS IN CHEMICAL COMPOUNDS. J. S. Baijal, J. A. Diaz, S. N. Kaplan, and R. V. Pyle (Univ. of California, Berkeley). Nuovo Cimento (10), 30: 711-26(Nov. 1, 1963). (UCRL-10671)

Experimental studies (NSA 17: 2246) of the relative μ^--meson atomic-capture probabilities in the compounds CuO, Sb_2O_3, PbO, CuS, Sb_2S_3, and PbS and in the metallic solutions $Ag_{0.58}Li$ and $CuAu_{0.18}$ were made to test the predictions of the "Fermi-Teller Z-law." In the experiment the capturing atom was identified by decomposing a compound lifetime curve obtained by detecting neutrons from μ^--capture. The measured atomic-capture ratios are:

Cu/O = 6.14 ± 0.85,	Sb/S = 1.64 ± 0.10,
Sb/O = 1.86 ± 0.096,	Pb/S = 2.87 ± 0.35,
Pb/O = 4.56 ± 0.53,	Ag/Li = 11.66 ± 3.39,
Cu/S = 1.89 ± 0.18,	Au/Cu = 0.34 ± 0.032.

Assuming the Z-dependence of the atomic-capture probability can be expressed as proportional to Z^n (n being any positive or negative number), it is found that the experimental results fall approximately in the range $n = \frac{1}{2}$ to $\frac{3}{2}$, where n = 1 corresponds to the theoretical prediction of Fermi and Teller. (auth)

9110 π^0-PRODUCTION BY 4.2 Gev π^--MESONS IN EMULSION. I. Kelson and G. Yekutieli (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo Cimento (10), 30: 734-9(Nov. 1, 1963).

Measurements of opening angles and angular distributions were made on electron pairs found in nuclear emulsions that were exposed to 4.2-Bev π^- mesons. An iteration method is developed to deduce the π^0-meson energy spectrum from the opening angle distribution of the pairs. Comparison between the observed angular distribution of pairs, and that from a Monte-Carlo calculation, based on π^+ mesons emitted from 4.2-Bev stars, shows a distinct forward π^0 component. The forward π^0 mesons are attributed to charge-exchange reactions of small momentum transfer. (auth)

9111 STRONG INTERACTION SYMMETRIES: A MODEL BASED ON SU(4). V. Amar (Università, Milan and Istituto Nazionale di Fisica Nucleare, Milan), A. Esteve, and P. G. Sona. Nuovo Cimento (10), 30: 772-83(Nov. 1, 1963).

A classification of elementary particles based on a group of rank 3 which allows to treat symmetrically the three additive quantum numbers, B, Y, T_3, is considered. The model implies the existence of a hypothetical particle X, with strangeness of the same sign of the baryon number, whose mass and decay are discussed. (auth)

9112 PERIODS OF MANDELSTAM'S BOUNDARY CURVES. M. Zăgănescu (Univ. of Timisoara, Rumania). Nuovo Cimento (10), 30: 784-90(Nov. 1, 1963).

Starting from the well-known equation of Mandelstam's boundary curve of a square diagram, the elliptic integral associated with this curve is studied. Legendre's modulus k^2 depends exclusively on the ratio m/μ of the mass of the nucleon and of the pion. For $\mu = m$ and $\mu = 2m$, the genus of the curve is zero. A birational correspondence can be established in this case between the coordinates of the two curves so that the corresponding diagrams are, in a certain sense, equivalent. The values of the spectral density and scattering amplitude on the boundary curve are calculated. The scattering amplitude is given by an elliptic integral of the third kind. (auth)

9113 ENERGY-MOMENTUM TRANSFERS IN HIGH-ENERGY NUCLEAR COLLISIONS. R. Raghavan, T. N. Rangaswamy, and A. Subramanian (Tata Inst. of Fundamental Research, Bombay). Nuovo Cimento (10), 30: 791-802(Nov. 1, 1963).

It is pointed out that the form of the distribution of energy-momentum transfers in the diffraction region of high-energy elastic proton-proton and pion-nucleon scattering is applicable to the longitudinal energy-momentum transfers in high-energy ($\lesssim 10^{12}$ ev) inelastic nucleon-nucleon collisions. Except for a change in the value of a parameter of the distribution, the same is also applicable to the momentum-transfer distribution in the collision of the virtual particles into which the nucleon-nucleon collisions can be decomposed on the basis of an assumed model. The implication of applying these energy-momentum-transfer distributions to the case of pion-nucleon collisions is examined briefly. (auth)

9114 PION AS A REGGE POLE. [PART] II. M. M. Islam and R. Piñon (Brown Univ., Providence). Nuovo Cimento (10), 30: 837-44(Nov. 1, 1963).

Predictions based on the pion as a Regge pole are compared with those for an elementary pion, in the framework of the one-pion-exchange model for $\pi + N \rightarrow \pi + \pi + N$ in the ρ-resonance region. (auth)

9115 WEYL REFLECTIONS IN THE UNITARY SYMMETRY THEORY OF STRONG INTERACTIONS. A. J. MacFarlane (Univ. of Rochester, N. Y.), E. C. G. Sudarshan, and C. Dullemond. Nuovo Cimento (10), 30: 845-58 (Nov. 1, 1963). (NYO-10266)

A rapid and general algebraic method is described for obtaining the effect of the Weyl reflections on the basis vectors of an arbitrary irreducible representation (IR) of SU_3. The important feature of the method is that it applies to those basic vectors of the IR that belong to the nonsimple weights of the IR and that can therefore not be treated by inspection of the weight diagram of the IR. Results are given for certain IR's of SU_3 relevant to the Ne'eman-Gell-Mann theory: the 8, 27, and 35 component IRs (1,1), (2,2), and (4,1) of SU_3. (auth)

9116 PROPERTIES OF THE DEUTERON REGGE TRAJECTORY AND LOW-ENERGY NEUTRON-PROTON SCATTERING. S. K. Bose (Inst. for Advanced Study, Princeton, N. J.) and M. Der Sarkissian. Nuovo Cimento (10), 30: 878-93(Nov. 1, 1963).

Low-energy neutron-proton scattering was studied in an attempt to understand the properties of the deuteron. The assumption is made that low-energy n-p scattering in the triplet state is dominated by the deuteron Regge pole. The Khuri form for the deuteron Regge pole is used and the properties of the deuteron trajectory are deduced given the effective-range parameters. The properties found for the deuteron Regge trajectory are just the ones expected. A simplified bootstrap calculation of the effective range parameters for n-p scattering in the triplet state was made. The deuteron Regge trajectory for the effective-range energy region is then specified without arbitrary parameters. A dynamical classification of particles based on the principle of self-consistency is discussed. (auth)

9117 A STUDY OF LOW-ENERGY $\pi-\Lambda$ SCATTERING. [PART] I. M. Der Sarkissian (Louisiana State Univ., Baton Rouge). Nuovo Cimento (10), 30: 894-900(Nov. 1, 1963).

An attempt is made to study low-energy p-wave $\pi-\Lambda$ scattering within the self-consistent S-matrix framework. By neglecting multichannel effects (as a first approximation) and taking account of the short-range forces using the Baláz effective-range formalism, the main features are found. The deviation from a completely self-consistent calculation is probably an indication of the importance of multichannel effects. (auth)

9118 SOME MASS RELATIONS INVOLVING BARYONS AND MESONS. W. Królikowski (Inst. for Nuclear Research, Warsaw and Univ. of Warsaw). Nuovo Cimento (10), 30: 966-8(Nov. 1, 1963).

The mass levels of baryons belonging, by hypothesis, to five unitary multiplets are given in an effort toward a dynamical explanation of excited baryons. The unitary multiplets include $J^P = \frac{1}{2}^+, \frac{3}{2}^+, \frac{1}{2}^-, \frac{3}{2}^-$, and $\frac{5}{2}^+$. (R.E.U.)

9119 DEPENDENCE OF MULTIPLICITY ON PRIMARY ENERGY IN NUCLEON-NUCLEON AND PION-NUCLEON COLLISIONS. P. K. Malhotra (Tata Inst. of Fundamental Research, Bombay). Nucl. Phys., 46: 559-71(Sept. 1963).

The available experimental data on N-N and π-N interactions were examined to ascertain the dependence of multiplicity on primary energy. It is found that the average multiplicity of the charged created particles increases about as the square root of the primary energy in the region of about 6 to 50 Gev and then progressively slower till it attains a constant value at high energies; this value is 16 ± 3 at 2-10 Tev for N-N collisions and 10 ± 2 at 0.2-1 Tev for π-N collisions. These observations indicate that at high energies the average multiplicity reaches a kind of saturation. This analysis leads to the interesting result that in N-N collisions. the average total energy per created particle in the center of momentum system is almost constant in the energy region $\lesssim$100 Gev but at high energies increases rapidly about as $E_N^{\frac{1}{4}}$. (auth)

9120 THE TRITON PROBLEM WITH TENSOR FORCES. B. S. Bhakar (Univ. of Delhi). Nucl. Phys., 46: 572-6(Sept. 1963).

The triton wave function in presence of tensor forces is investigated, when full symmetry of the three-nucleon system in configuration, spin, and isobaric spaces is taken into account assuming separable potentials to operate between pairs. The wave function for the three-particle system involves only single parameter functions, two in the case of central forces and three in the case of tensor forces, resulting in a corresponding number of coupled one-dimensional integral equations. (auth)

9121 ELASTIC SCATTERING OF DEUTERONS BY DEUTERONS AT 25.3 Mev. W. T. H. Van Oers, H. Arnold, and K. W. Brockman, Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam). Nucl. Phys., 46: 611-16(Sept. 1963).

The differential cross section for elastic scattering of 25.3-Mev deuterons by deuterons was measured for center-of-mass scattering angles between 13.95 and 97.4°. Elastically scattered deuterons were detected with a counter telescope used in conjunction with a particle identification circuit to provide the necessary separation of proton, deuteron, and triton pulse-height spectra. In this arrangement He^3 particles were not recorded. Measurements were repeated for a group of center-of-mass scattering angles smaller than 33° using a single scintillator. In this case aluminum absorbers were used to obtain the separation of the group of elastically scattered deuterons from the He^3 and triton groups. The angular distribution does not show a Coulomb-nuclear interference minimum in the region of small angles. A small relative maximum in the cross section arises around 90°. (auth)

9122 ANGULAR AND ENERGY DEPENDENCE OF THE POLARIZATION OF D-D NEUTRONS. H. J. Boersma, C. C. Jonker, J. G. Nijenhuis, and P. J. Van Hall (Vrije Universiteit, Amsterdam). Nucl. Phys., 46: 660-8(Sept. 1963).

The polarization of D-D neutrons was measured for a deuteron energy of 375 kev at 10 different reaction angles between 0 and 80° (lab) and for deuteron energies of 275 and 450 kev at 50° (lab). The thickness of the targets was 50 kev. The experimental setup used He^4 as analyzer and included α-n coincidence measurement and γ-n discrimination. Attention was paid to the elimination of false coincidences that reduce the polarization. The maximum polarization for 375 kev is found to be −13.5% the absolute value being larger than the value of Pasma (−9%). The differential polarization contains a small sin 4ϑ contribution. (auth)

9123 ASYMPTOTIC PHASE-SHIFTS AND BOUND STATES FOR TWO-BODY CENTRAL INTERACTIONS. P. Swan (Univ. of Melbourne). Nucl. Phys., 46: 669-94 (Sept. 1963).

Levinson's theorem is proved for the elastic, two-body scattering of both neutral and of charged particles, for arbitrary angular momentum states. The necessary restriction on the interaction potential U(r) is $r^2U(r) = 0$ at $r = 0$ and $r = \infty$, with $U(r > 0)$ finite. The theorem also applies to the equivalent two-body potential between complex particles. Levinson's relation for the l-wave phase-shift $\eta_l(k)$ gives $\eta_l(0) - \eta_l(\infty) = n_l\pi$, with $\eta_l(\infty) = 0$, where n_l is the number of composite bound states. If there is an $l = 0$ resonance at zero energy, this is modified to $\eta_0(0) - \eta_0(\infty) = (n_0 + \frac{1}{2})\pi$. Coulomb bound states do not obey this relation, as $r^2V(r) \neq 0$ at $r = \infty$. The special case of the inverse square potential, in those cases where $\eta_l(k)$ can be defined, gives the result $\eta_l(k) =$ constant for all k. Attractive potential wells with repulsive singular cores, not obeying the restriction $r^2U(r) = 0$ at $r = 0$, are shown to lead to $\eta_l(0) = n_l\pi$, and $\eta_l(\infty) = -\text{const.}\ k^p$, with $0 \leq p \leq 1$, where p increases from 0 to 1 as the order of the singularity increases from 2 to ∞. The values of $\eta_l(0)$ and $\eta_l(\infty)$ largely condition the shape of the $\eta_l(k)$ function, which is otherwise arbitrary by integral multiples of π. Examples of the variation of $\eta_0(k)$ with k and potential well strength are given graphically for the square well. Their behavior is related to the general properties $\eta_l(k \to 0) \propto k^{2l+1}$ and $\eta_l(k \to \infty) \propto 1/k$, and to the existence of shape resonance scattering masked by hard sphere (potential) scattering. (auth)

9124 A STUDY OF LOW-ENERGY $\pi-\Lambda$ SCATTERING. [PART] II. M. Der Sarkissian (Louisiana State Univ., Baton Rouge). Nuovo Cimento (10), 30: 1005-8 (Nov. 16, 1963).

A method suggested by Chew is applied to low-energy $\pi-\Lambda$ scattering in order to relate the residues of the true Σ and true Y_1^* poles. The result is $\gamma_{Y_1^*} \approx \frac{3}{4}\gamma_\Sigma$; this numerical relation is in rough agreement with experimental information now available for these residues. (auth)

9125 POLARIZATION EFFECTS IN HIGH-ENERGY WEAK INTERACTIONS. S. L. Adler (Princeton Univ., N. J.). Nuovo Cimento (10), 30: 1020-39(Nov. 16, 1963).

The cross-section for the production of a polarized lepton and baryon in the reaction, neutrino + nucleon → lepton + baryon, is computed exactly to lowest order in the weak interaction. Results are given in covariant form, and in the center-of-mass system of the reaction, expressed directly in terms of the lepton and baryon decay asymmetries. The results are discussed with special emphasis on determining the form factors in the strangeness-changing weak interactions, on isolating induced scalar and induced pseudoscalar effects, and on testing time-reversal invariance in high-energy weak interactions. (auth)

9126 QUASI-ELASTIC p-α COLLISIONS. Y. Sakamoto (National Research Council, Ottawa). Nuovo Cimento (10), 30: 1073-82(Nov. 16, 1963).

The quasi-elastic p-α collision gives information about the clustering of the nucleons within the nucleus. Since the quasi-free p-p scattering was successful in clarifying the single-particle shell structure of nuclei, single-particle harmonic oscillator wave functions are used to calculate the angular correlation distribution of the quasi-elastic p-α collision. An interaction length is defined in terms of the probability of finding the α-particle cluster within the nucleus. (auth)

9127 WEAK-INTERACTION CORRECTIONS TO THE ELECTROMAGNETIC INTERACTIONS OF LEPTONS. R. D. Amado and L. Holloway (Univ. of Pennsylvania, Philadelphia). Nuovo Cimento (10), 30: 1083-93(Nov. 16, 1963).

In order to examine the structure of weak interactions the effects of the higher-order weak interactions on the electromagnetic properties of the charged leptons both in the V−A form of the phenomenological Lagrangian theory of Fermi and in the vector boson theory were calculated. It is found that the vector boson theory gives a contribution of $\sim 0.25 \times 10^{-6}$ to the muon's anomalous magnetic moment and a small parity nonconserving part to the electromagnetic current. The expected anomalous magnetic moment correction in the phenomenological Lagrangian theory is surprisingly absent. Experimental consequences are discussed. (auth)

9128 RELATIVISTIC CORRECTIONS TO ELASTIC ELECTRON-DEUTERON SCATTERING. J. Tran Thanh Van (Laboratoire de Physique Théorique et Hautes Energies, Orsay, France). Nuovo Cimento (10), 30: 1100-7(Nov. 16, 1963).

The relativistic corrections to elastic electron-deuteron scattering were calculated in the impulse approximation. A deuteron wave function resulting from the Bethe and Salpeter equation with a separable kernel is used to evaluate the structure functions of the deuteron. The analysis of the experimental results gives a neutron charge form factor almost equal to zero or slightly negative for $q^2 \leq 2$ $(\text{fermi})^{-2}$. (auth)

9129 $\Sigma \rightarrow \Lambda + e + \nu$ DECAY UP TO FIRST ORDER IN THE Q-VALUE. G. Russo (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo Cimento (10), 30: 1108-12(Nov. 16, 1963).

Weak magnetism effects are considered in the $\Sigma \rightarrow \Lambda + e + \nu$ decay up to first order in the Q-value. In this approximation it is shown that it is possible to determine the coupling constants if a sample of polarized Σ is available. (auth)

9130 THE REGGE FORMALISM FOR RELATIVISTIC PARTICLES WITH SPIN. S. Mandelstam (Univ. of Birmingham, Eng.). Nuovo Cimento (10), 30: 1113-26(Nov. 16, 1963).

The scattering amplitude for particles of spin σ_1 and σ_2 is examined in the angular-momentum plane, and the perturbation terms are found to have poles at the positive integers below $\sigma_1 + \sigma_2$ or at the corresponding half-integers if $\sigma_1 + \sigma_2$ is half-integral. In the complete amplitude, the poles begin to move away from these values as the coupling is turned on. However, the amplitude in the j-plane, obtained by analytically continuing the amplitude from values of j greater than $\sigma_1 + \sigma_2 - 1$, will not be equal to the physical partial-wave amplitudes at the points in question. In the presence of a third double-spectral function, the states of the wrong signature will have essential singularities of the Gribov-Pomeranchuk type at these points. The results are also valid in processes that can have an intermediate state with particles of spin σ_1 and σ_2. If the spinning particles are themselves Regge particles, all these statements may require modification. (auth)

9131 CUTS IN THE ANGULAR-MOMENTUM PLANE. [PART] I. S. Mandelstam (Univ. of Birmingham, Eng.). Nuovo Cimento (10), 30: 1127-47(Nov. 16, 1963).

A study is made of the Feynman diagram for which Amati, Fubini, and Stanghellini propose the existence of cuts in the angular-momentum plane. It is concluded that such cuts are not present in the complete diagram, though they exist in each of the dispersion diagrams corresponding to it. Amati, Fubini, and Stanghellini had only considered one dispersion diagram. These results apply only to a particular class of Feynman diagrams, not to all diagrams. From the results it can be shown that the conclusions of the previous paper must be modified when the spinning particles are not elementary. Finally, it is pointed out that the remaining divergencies of the strip approximation are cancelled by other terms. As these terms involve multiparticle intermediate states, it is not evident how to include them in a practical calculation. (auth)

9132 CUTS IN THE ANGULAR-MOMENTUM PLANE. [PART] II. S. Mandelstam (Univ. of Birmingham, Eng.). Nuovo Cimento (10), 30: 1148-62(Nov. 16, 1963).

The cuts in the angular-momentum plane proposed by Amati, Fubini, and Stanghellini are examined further and, in diagrams more complicated than their original diagram, they are found to be present. Such cuts are closely related to the essential singularities found by Gribov and Pomeranchuk. In a channel where the two-particle states do not consist of elementary particles, the essential singularities will occur on one side of the cut in the angular-momentum plane only. As a result the Gribov-Pomeranchuk singularities in such channels do not contribute to the asymptotic behavior in the physical region. (auth)

9133 ON THE POSSIBILITY OF OBSERVING FARADAY ROTATION USING THE MÖSSBAUER EFFECT. M. Iannuzzi and E. Polacco (Università, Pisa, Italy). Nuovo Cimento (10), 30: 1163-5(Nov. 16, 1963).

An experiment is suggested for observing the rotation of the polarization plane of linearly polarized γ rays that pass through an absorbing medium. The experiment involves the Mössbauer effect in metallic iron at room temperature. (C.E.S.)

9134 SCATTERING OF NEUTRONS BY α-PARTICLES AT 14.1 Mev. U. Fasoli and G. Zago (Università, Padova and Istituto Nazionale di Fisica Nucleare, Padova). Nuovo Cimento (10), 30: 1169-81(Dec. 1, 1963).

The angular distribution of 14.1-Mev neutrons elastically scattered by α particles was measured by observing the α recoils in a helium-filled cloud chamber. The results are in satisfactory agreement with those previously obtained by

others. Inspection of the small-angle region of the measured distribution shows that phase shifts of orbital angular momentum higher than L = 1 are not negligible, although, according to the present experiment, quantitative information on D-waves turns out to be somewhat elusive. The azimuthal angular distribution agrees well with the value P = 0.02 of the neutron beam polarization, as measured by Perkins. (auth)

9135 PRODUCTION OF CASCADE PARTICLES. R. C. King (Imperial Coll., London). Nuovo Cimento (10), 30: 1220-44(Dec. 1, 1963).

A model to describe the production of cascade particles in K-p collisions is set up in which the pole contribution of the Λ and Σ particles and the contributions of two-particle intermediate states are considered. These latter states are approximated by Y* resonances in the s and u channels and by a D-particle or resonance, a boson of strangeness 2, in the t channel. The two alternatives of spin ½ and spin ³/₂ Ξ are considered. A field-theoretical technique is used in which all spin ³/₂ states are described by the Rarita-Schwinger formalism. The differential and total cross sections for the production process are calculated at various energies for all possible parity combinations. A comparison with the experimental data indicates that the spin of the cascade particle is not ³/₂. The production process is anti-peripheral in the sense that the dominant mechanism is fermion exchange in the u channel. The data can best be fitted by the parity combinations P(ΛΣ) even, P(KΛN) odd and P(KAΞ) odd. In this case it is also required that $g_{K\Lambda N}g_{K\Lambda N\Xi} \approx g_{K\Sigma N}g_{K\Sigma\Xi}$. There is also some evidence for a peripheral process mediated by a D-particle or KK resonance. The analysis indicates that such a state, with isospin 1, should have spin 0 and even parity. The mass cannot be established but a mass of 1,000 Mev and a width of 130 Mev is consistent with cascade production in both K-p and $\bar{p}$-p collisions. (auth)

9136 THE REGGE ASYMPTOTIC REPRESENTATION OF THE SCATTERING AMPLITUDE BELOW THE ELASTIC THRESHOLD. A. Q. Sarker (Univ. of Birmingham, Eng.). Nuovo Cimento (10), 30: 1298-1311(Dec. 1, 1963).

It is shown that the scattering amplitude A(s,t) can be represented in terms of the Regge poles and a vanishing background integral and summation in the region $-\infty < t < 4\mu^2$, $|t| \to \infty$. This is achieved by using a slightly different integral transform than that given by Sommerfeld and Watson and the extended Regge formula, due to Mandelstam. Elastic unitarity and a condition of boundedness of the absorptive part of the amplitude are assumed. The principle of crossing symmetry is not assumed explicitly. (auth)

9137 NUCLEON-ANTINUCLEON POTENTIAL AND THREE-PION ANNIHILATION AT REST. H. Pilkuhn (Univ. of Stockholm). Nuovo Cimento (10), 30: 1312-16(Dec. 1, 1963).

In the S_1^{3-} state, a repulsive nucleon-antinucleon potential suppresses two-meson annihilation for which the annihilation force is found to be of shorter range than for multimeson states. (auth)

9138 RADIATIVE MUON DECAY MEDIATED BY A VECTOR BOSON. R. C. Brunet (Imperial Coll., London). Nuovo Cimento (10), 30: 1317-24(Dec. 1, 1963).

The spectrum of the photon and the electron emitted in a radiative muon decay mediated by a vector boson is calculated. The deviations of the spectrum from that for a (V−A) Fermi interaction are, to first order, inversely proportional to the square of the mass of the intermediate boson. These deviations for certain electron and photon energies may be substantial enough to enable an approximate determination of the mass of the vector boson. (auth)

9139 A MODEL FOR FINAL-STATE INTERACTIONS. G. Bonnevay (Faculté des Sciences, Orsay and Faculté des Sciences, Bordeaux). Nuovo Cimento (10), 30: 1325-43 (Dec. 1, 1963).

A model for final-state interactions in which only two-body forces in only one partial wave are taken into account is discussed. The importance of the logarithmic singularities due to the first two rescatterings, when the two-body interaction takes place through a resonance, is emphasized. Singularities due to all rescatterings are found on successive Riemann sheets. There is an infinite number of singularities on each sheet, and it is shown that their distance to the physical region on the Riemann surface increases with the order of rescattering. (C.E.S.)

9140 $Y_1^+ + \bar{Y}_1^+ (\Sigma + \bar{\Sigma})$ PAIR PRODUCTION IN p-$\bar{p}$ COLLISION. S. Minami (Louisiana State Univ., Baton Rouge). Nuovo Cimento (10), 30: 1344-6(Dec. 1, 1963).

The π-K crossing exchange model is used to investigate the branching ratios $(p + \bar{p} \to Y_1^{*+} + \bar{Y}_1^{*-}) : (p + \bar{p} \to Y_1^{*-} + \bar{Y}_1^{*+}) : (p + \bar{p} \to Y_1^{*0} + \bar{Y}_1^{*0})$ and $(p + \bar{p} \to \Sigma^+ + \bar{\Sigma}^-) : (p + \bar{p} \to \Sigma^- + \bar{\Sigma}^+) : (p + \bar{p} \to \Sigma^0 + \bar{\Sigma}^0)$. (C.E.S.)

9141 HIGHER-ORDER CALCULATION OF THE ELECTRON-PAIR PRODUCTION CROSS-SECTION. D. S. Moroi and C. L. Hammer (Ames Lab., Ames, Iowa). Nuovo Cimento (10), 30: 1396-1405(Dec. 16, 1963).

The pair production cross-section is calculated to order $\alpha^3 Z^3$ for the case where the incident photon and one of the electrons have an energy much greater than mc^2. Comparison of these calculations to the experimental data of Plimpton and Hammer shows an improvement in agreement between theory and experiment of approximately a factor of $1 + (\alpha Z 4\pi/15)$ for low positron kinetic energies. However, for positron kinetic energies of the order of 1 Mev no improvement is obtained. In addition it is shown for large-angle emission of the positron (electron) that the Bethe-Heitler cross-section multiplied by the Coulomb factor gives the correct cross-section to lowest order in αZ. (auth)

9142 RADIATIVE CORRECTIONS TO MUON-ELECTRON SCATTERING. K. E. Eriksson, B. Larsson, and G. A. Rinander (Uppsala Univ.). Nuovo Cimento (10), 30: 1434-44(Dec. 16, 1963).

Formulas are given for the differential cross section for muon-electron scattering to order α^3 for the case of a small energy resolution that is independent of the directions in the c.m.s. Approximate formulas are then derived for the low-energy and the high-energy limits. Results from numerical computations are given. (auth)

9143 K-NUCLEON INTERACTIONS AND Y_1^*-RESONANCE. Ramesh Chand (Syracuse Univ., N. Y.). Nuovo Cimento (10), 30: 1445-51(Dec. 16, 1963).

A theoretical method is given for distinguishing between Watson's two sets of zero effective-range $\bar{K}\Lambda$ scattering parameter solutions, called solution A and solution B, which fit the K^--p data quite well in the K^--laboratory momentum range of (350 + 450) Mev/c. These two sets of solutions, which are quite similar in both the s- and d-waves but differ considerably in p-wave, are combined with the parameters, obtained by requiring Y_1^*-resonance at 1385 Mev with width 50 Mev as an I = 1, $p_{\frac{3}{2}}$-wave, bound state of the $\bar{K}$-nucleon system, so as to give two new sets of energy-dependent $\bar{K}\Lambda$ scattering parameters in I = 1, $p_{\frac{3}{2}}$-state. It is found that the zero effective-range expansion for p-wave $\bar{K}\Lambda$ phase shift and the scattering parameters of Watson's solution B are inconsistent with the requirements of causality and of the positive definiteness of transition probabilities. (auth)

9144 ANALYTICITY AND PHASE RETRIEVAL. P. Roman and A. S. Marathay (Boston Univ.). Nuovo Cimento (10), 30: 1452-64(Dec. 16, 1963).

The general problem of constructing a spectrum $g(\nu)$ from the knowledge of the magnitude of its Fourier transform $|\gamma(\tau_r)|$ is considered. The question reduces to locating the zeros of the analytic continuation $\gamma(\tau)$ in the upper half-plane. It is shown that if $g(\nu)$ is real, the complex zeros of $\gamma(\tau)$ in the upper half-plane either are on the imaginary axis or occur pairwise in a symmetrical position. If, in addition, $g(\nu) \geq 0$, the zeros on the imaginary axis disappear. The condition $g(\nu) \geq 0$ also leads to the requirement that $\gamma(\tau)$ must be representable as a convolution of a function $h(\tau)$ with itself. The analytic properties of $h(\tau)$ and the equations to determine it are discussed. Possible ways to obtain the solution of the ensuing nonlinear eigenvalue problem are suggested. (auth)

9145 UNITARITY AND ANALYTICITY IN THE COMPLEX ENERGY PLANE OF GENERAL SCATTERING AMPLITUDES. N. S. Kronfli (Univ. of London). Nuovo Cimento (10), 30: 1465-77(Dec. 16, 1963).

By assuming analyticity in the energy plane and using unitarity, it is found that the relativistic scattering amplitudes of general processes have no singularities in the energy plane except branch points at the thresholds, when keeping the momentum transfer variables in their physical range. These branch points are of the square root type or logarithmic according to whether the number of particles in the corresponding intermediate states is even or odd, respectively. The normal threshold behavior of the Feynman amplitudes is considered in detail and is found to agree with the above results. Continuation of the general amplitudes into their various unphysical Riemann sheets was also obtained. (auth)

9146 DISTRIBUTION OF PIONS IN NUCLEON CLOUDS. Q. A. M. M. Yahya (Imperial Coll. of Science and Tech., London). Nuovo Cimento (10), 30: 1487-99 (Dec. 16, 1963).

The fluctuation of pions in nucleon clouds is studied using statistical methods. The probability that in an interval of time a certain number of pions would reach the physical nucleon cloud and be reabsorbed in the core is obtained in a method analogous to the waiting time problem in statistics. The probability that a specified number of cloud states would be formed after some transitions of pions is found explicitly by means of generating functions. (auth)

9147 SYSTEMATIZATION OF MASS LEVELS OF PARTICLES AND RESONANCES ON HEURISTIC BASIS. T. Takabayasi (Nagoya Univ., Japan). Nuovo Cimento (10), 30: 1500-11(Dec. 16, 1963).

Once more a scheme of simple mass rules and formulas for particles and resonant levels is investigated and organized, based on some general hypotheses. The essential ingredients in the scheme are, on one hand, the equal-interval rule governing the isosinglet meson series, associated with particularly simple mass ratio between the 2^{++} level f and 0^{++} level ABC, and on the other a new basic mass formula that unifies some of the meson and baryon levels. The whole baryon levels are arranged in a table analogous to the periodic table, and then correspondences between different series and equivalence between spin and hypercharge, when properly applied, just fix the whole baryon mass spectrum in good agreement with observations. Connections with the scheme of mass formulas formerly given are also shown. (auth)

9148 THE CONCEPT OF MATTER WAVES, ELECTROMAGNETIC WAVES, AND SCATTERING. PART II. SOME DEDUCTIONS FROM THE NEW POSTULATES AND EXTENSION OF THE THEORY. Muhammad Ashraf Siddiqi (Univ. of Peshawar, Pakistan). Pakistan J. Sci. Ind. Res., 6: 140-4(July 1963).

The consequences of the two new postulates introduced previously are developed. Since the momentum of the associated waves $h\nu/v$ equals $m_0 v/\sqrt{1-v^2/c^2}$, the momentum of the particle, it is seen that the momentum of the particle and its vector character are wholly accounted for by the momentum of the associated waves, and the unconverted mass of the particle retains its scalar character and is tied up with its associated waves with the help of a binding energy. Assuming that the two parts of associated waves derived respectively from the external work and the parent mass retain their separate identities, two separate names "kinetic energy waves" and "matter waves" are given to these parts respectively. The various phenomena of emission and absorption of radiation are then logically explained on the basis that radiation is always absorbed in the matter wave form only and that in any single transition, radiation is emitted either in the form of kinetic energy waves entirely or in the form of matter waves entirely. It is shown that radiation in transit consists of waves of both the types. It is then postulated that the matter waves in transit (identified as photons) adjust themselves so as to become coherent with any closely accompanying kinetic energy waves (identified as electromagnetic waves) of the same frequency. The law of conservation of linear momentum is applied to fast electrons going from one field to another and also to reflection and refraction of kinetic energy waves and matter waves or photons assumed to be moving with different velocities in different media. It is shown that the electrons follow the law $\sin\theta_i/\sin\theta_r = (v/u)\sqrt{1-u^2/c^2}/\sqrt{1-v^2/c^2}$ that can be tested experimentally, and the waves and photons follow the usual laws of reflection and refraction applicable to light waves. It is stated that from the results of the experiments on excitation of atoms and emission of x rays with the impact of high velocity electrons, the energy used in binding the waves of the two types corresponding to different velocities of the electron can be calculated. (auth)

9149 SOME REMARKS ON LEPTON DECAYS OF HYPERONS. V. A. Lyul'ka and A. A. Startzev (Kurchatov Inst. for Atomic Energy, Moscow). Phys. Letters, 7: 283-4(Dec. 1, 1963).

The lepton energy spectrum is studied at a fixed nucleon energy. Electron and ${}_{\Lambda}H^4$ decays are considered in the study of leptonic decay of hyperons. (R.E.U.)

9150 FURTHER MEASUREMENTS ON THE DECAY $\pi^+ \to e^+ + \nu + \gamma$. P. Depommier, J. Heintze, C. Rubbia, and V. Soergel (CERN, Geneva). Phys. Letters, 7: 285-7(Dec. 1, 1963).

The radiative electronic decay $\pi^+ \to e^+ + \nu + \gamma$ is studied because it yields information on nonlocal effects in the decay due to strongly interacting particles or to an intermediate boson transmitting the weak interaction. A 70-Mev π-meson beam was slowed down by a carbon absorber and $e^+ - \gamma$ coincidences were found. The mass of the intermediate boson is assumed to be (1400 ± 300) Mev/c^2. (R.E.U.)

9151 POSSIBLE EXISTENCE OF $\bar{K}NN$ BOUND STATES. Y. Nogami (National Research Council, Ottawa). Phys. Letters, 7: 288-9(Dec. 1, 1963).

It is conceived that $\bar{K}NN$ bound states, or more generally $\bar{K}$-nucleus bound states, can exist from an interpretation of Y_0^* as a $\bar{K}$-N bound state. Three possible isospin configurations are considered. (R.E.U.)

9152 ON THE CORRESPONDENCE BETWEEN RESONANCES AND S-MATRIX POLES FOR BROKEN

SYMMETRIES. D. Amati (CERN, Geneva). Phys. Letters, 7: 290-2(Dec. 1, 1963).

A two-channel dynamical calculation is made for $\pi\Lambda$ and $\pi\Sigma$ interactions in the limited symmetry. The movement of the poles in the S-matrix in the different sheets in the complex energy plane is traced, related to the presence of a resonance, and the validity of a dynamical result concerning the mass difference of the resonances in terms of the mass difference of the elementary particles is discussed. (R.E.U.)

9153 POLARIZATION OF THE ω MESON. M. Jacob and A. Morel (Service de Physique Théorique, Saclay, France). Phys. Letters, 7: 350-1(Dec. 15, 1963).

It is shown that the tensorial part of the density matrix that describes the polarization of the meson(ω) can be obtained from the angular distribution of any one of the 3 mesons(π) produced in the main decay mode, $\omega \rightarrow \pi^+\pi^-\pi^0$. An analysis of $\pi^0\gamma$ mode is necessary to obtain the remaining vectorial polarization terms. (L.B.S.)

9154 NUCLEON-ANTINUCLEON INTERACTION AT LOW ENERGIES. Yu. P. Elagin, P. E. Nemirovskii, and Yu. F. Strokov (Kurchatov Inst. for Atomic Energy, Moscow). Phys. Letters, 7: 352-4(Dec. 15, 1963).

Results of an investigation of nucleon-antinucleon interactions, at 20 to 120 Mev, are given. Cross sections and angular distribution calculations are presented for σ_a ($p\bar{p}$), σ_s ($p\bar{p}$), and α_{ce} ($p\bar{p} \rightarrow n\bar{n}$) processes. It is concluded that $N\bar{N}$ collisions at non-relativistic energies can be described by an optical model, the optical potential $U = V + iW$ weakly depending on the energy. (L.B.S.)

9155 ISOSPIN PURITY ON THE λ AND Σ^0 HYPERONS. M. Wellner (Indiana Univ., Bloomington). Phys. Letters, 7: 355-6(Dec. 15, 1963).

Two experiments designed to test the isospin purity of Σ^0 and Λ^0 hyperons are suggested. The first might detect the presence of an isospin mixture; the second might be used to determine the degree of mixing. (L.B.S.)

9156 CONTRIBUTION OF INTERMEDIATE VECTOR BOSON TO THE μ-MESON'S g-2 BY Z LIMITING PROCESS. G. Segrè (CERN, Geneva). Phys. Letters, 7: 357-8(Dec. 15, 1963).

Calculations of the contribution of intermediate vector bosons to the μ-meson's g-2 are made to obtain a greater accuracy in the anomalous magnetic moment of the μ-meson, for the cases where κ equals zero and κ differs from zero. (L.B.S.)

9157 PROPERTIES OF THE ω MESON FROM $K^- + p \rightarrow \Lambda + \omega$. J. J. Murray, Jr., M. Ferro-Luzzi, D. O. Huwe, J. B. Shafer, F. T. Solmitz, and M. Lynn Stevenson (Univ. of California, Berkeley). Phys. Letters, 7: 358-63 (Dec. 15, 1963). (UCRL-10723(Rev.))

Events of the type $K^- + p \rightarrow \Lambda + \omega$; obtained with the 72-inch bubble chamber utilizing a beam of 1.51-Bev/c mesons(K^-) extracted from the Bevatron, were studied, and decay modes of the mesons(ω) are analyzed. Cross sections and branching ratios for the two-pion, neutral, and three-pion decay modes are determined along with other properties of mesons(ω). (L.B.S.)

9158 ON THE NATURE OF THE SINGULARITY OF A PARTIAL-WAVE SCATTERING AMPLITUDE AT THE NEGATIVE INTEGRAL VALUE OF J. E. J. Squires (Univ. of Edinburgh). Phys. Letters, 7: 363-4(Dec. 15, 1963).

The N over D method is used to determine the form of the singularity of the partial-wave scattering amplitude in the J-plane at negative integers. Solutions to the equations of this method led to expressions which satisfy elastic singularity on the right-hand cut and left-hand discontinuity from $\nu = -1$ to $\nu = -\infty$. (L.B.S.)

9159 NEUTRON–PROTON CHARGE EXCHANGE SCATTERING. D. V. Bugg (National Inst. for Research in Nuclear Science, Chilton, Berks, Eng.). Phys. Letters, 7: 365-7(Dec. 15, 1963).

The difference between the diffraction scattering in the isotopic spin T = 1 and T = 0 channels, which is attributed to the long tail of the T = 1 state, is presented as a possible explanation of the narrow peak observed by Palevsky et al. in the angular distribution of n-p exchange scattering, at 2.04 and 2.85 Bev. (L.B.S.)

9160 A MEASUREMENT OF THE e^+ POLARISATION IN MUON DECAY: THE e^+ ANNIHILATION METHOD. A. Buhler, N. Cabibbo, M. Fidecaro, T. Massam, Th. Muller, M. Schneegans, and A. Zichichi (CERN, Geneva). Phys. Letters, 7: 368-71(Dec. 15, 1963).

The experimental design for measuring the e^+ polarization in μ^+ decay by e^+ annihilation in magnetized iron foil is described. From measurements based on two foil orientations, a value of $P_{(e^+)} = (105 \pm 30)\%$ was obtained, which is consistent with predictions of the (V-A) theory of weak interactions. (L.B.S.)

9161 POSSIBILITY OF VECTOR MESON EXCHANGE IN PION PRODUCTION IN PROTON-PROTON COLLISIONS. A. B. Clegg (Nuclear Physics Lab., Oxford). Phys. Letters, 7: 371-2(Dec. 15, 1963).

Further development of the one-pion model to explain deviations in experimental measurements of pion-nucleon scattering is suggested to include the possibility of ρ-meson exchange. Ways in which such possibilities could be tested further are presented. (L.B.S.)

9162 RESONANCE POLES AND MASS DIFFERENCES WITHIN UNITARY MULTIPLETS. R. H. Dalitz and G. Rajasekaran (Clarendon Lab., Oxford). Phys. Letters, 7: 373-7(Dec. 15, 1963).

The dependence of a multichannel resonant state on the threshold energies for these channels, and the relation between these channels and the resonance poles of the scattering matrix is studied. Expressions showing that multichannel resonance is characterized by a set of poles in complex conjugate pairs, rather than a single pole, are derived on the basis of the s-wave k-matrix model and the conclusions are discussed. (L.B.S.)

9163 OBSERVATION OF THE PION PRODUCTION BY A λ HYPERON. M. Bardadin (Univ. of Warsaw) and L. Michejda. Phys. Letters, 7: 377-8(Dec. 15, 1963).

An illustration, taken from the Saclay 81-cm HBC, of the event described by the reaction, $\Lambda + p \rightarrow \Sigma^- + p + \pi^+$, is presented. The momenta and identification of the particles from track measurements are tabulated. (L.B.S.)

9164 STUDIES OF THE OPTICS OF NEUTRONS. II. SPIN-INDEPENDENT INTERACTION BETWEEN NEUTRONS AND ELECTRONS. Otto Halpern (Pacific Palisades, Calif.). Phys. Rev., 133: B579-80(Feb. 10, 1964).

After a discussion of the three known experimental methods for determining the spin-independent neutron-electron interaction, the various drawbacks of each are shown. In particular, the method based on measuring an angle of total reflection and thereby deducing under proper assumptions the value for the amplitude of the neutron-electron interaction is shown to carry with it a grave uncertainty arising from the fact that the amplitudes compared in the reflection experiments were deduced from cross-section measurements that contain a poorly determined contribution from incoherent scattering. (auth)

9165 K^--p ELASTIC SCATTERING IN THE ONE Bev/c RANGE. L. Sodickson, I. Mannelli, D. Frisch, and M. Wahlig (Massachusetts Inst. of Tech., Cambridge). Phys. Rev., 133: B757-67(Feb. 10, 1964). (TID-19390)

Differential K^- p elastic-scattering cross sections were measured at four momenta in the range corresponding to the T = 0, 1815-Mev K^- p resonance, using a cylindrical spark chamber sourrounding a liquid-hydrogen target. The integrated elastic-scattering cross sections follow the known resonant behavior of the total cross section, and are (18.7 ± 0.7), (23.3 ± 1.0), (17.3 ± 1.1), and (15.2 ± 0.7) mb at 820, 1040, 1150, and 1260 Mev/c bombarding momentum, respectively. It is necessary to include $\cos^5\theta^*$ terms in order to fit the angular distributions at 1040 and 1150 Mev/c, and within the accuracy of the experiment higher terms in cos θ^* are not needed throughout the resonance region. This implies that the resonance is due to $D_{\frac{5}{2}}F_{\frac{5}{2}}$ interference, and that the simplest assignment for the spin of the resonance is $J = \frac{5}{2}$. No conclusion can be inferred about the parity. (auth)

9166 SEARCH FOR THE DECAY $\mu^+ \rightarrow e^+ + \gamma$. Sherwood Parker, Herbert L. Anderson, and Charles Rey (Univ. of Chicago). Phys. Rev., 133: B768-78(Feb. 10, 1964).

A search was conducted for the decay $\mu^+ \rightarrow e^+ + \gamma$ using spark chambers, scintillators, and fast oscilloscopes. The number of stopped pions, 7.39×10^9, and the detection efficiency of the apparatus for $\mu \rightarrow e + \gamma$ events, 3.9%, would predict the detection of 3 events for a branching ratio of 10^{-8}. No evidence for the existence of this decay was found. The distribution in range of the e^+ in graphite, and of the (e,γ) angle for the events found near 180° was consistent with that expected from $\mu^+ \rightarrow e^+ + \nu + \overline{\nu} + \gamma$. The probability of finding the observed distribution was calculated to be greatest for an assumed $\mu \rightarrow e + \gamma$ branching ratio of zero. This probability drops below 50% of this value if the branching ratio is 0.6×10^{-8}, and below 10% for 2.2×10^{-8}. (auth)

9167 UNCROSSED LADDER GRAPHS IN THE FEINBERG-PAIS THEORY OF LEPTONIC WEAK INTERACTIONS. Yih Pwu (Univ. of Pennsylvania, Philadelphia) and Tai Tsun Wu. Phys. Rev., 133: B778-88(Feb. 10, 1964).

The Feinberg-Pais theory of summing the uncrossed ladder graphs is re-examined. A single regularization of the W propagator is used throughout. Instead of the iterative procedure used previously, the leading terms of the individual graphs are summed exactly. The result of Feinberg and Pais for energies much below 300 Bev is obtained for all energies in the limit of infinite regulator mass. (auth)

9168 N* REGGE POLE AND PION-NUCLEON (3,3) PHASE SHIFTS. S. K. Bose and S. N. Biswas (Tata Inst. of Fundamental Research, Bombay). Phys. Rev., 133: B789-90(Feb. 10, 1964).

The consequence of the hypothesis that the N* lies on a Regge trajectory for the low-energy pion-nucleon phase shifts in the $J = \frac{3}{2}$, $T = \frac{3}{2}$ state is investigated using the Khuri representation. (auth)

9169 SPECULATIONS ON THE PRODUCTION OF VECTOR MESONS. S. M. Berman and S. D. Drell (Stanford Univ., Calif.). Phys. Rev., 133: B791-801(Feb. 10, 1964). (SLAC-PUB-16)

Various approximate methods are applied in order to estimate vector boson production at high energies. Most of the calculations refer to photon-induced interactions, but in addition a certain class of reactions induced by π and K beams is discussed. The photoproduction of ρ's and ω's is considered by a diffraction mechanism as well as by a one-pion-exchange mechanism. Both of these methods lead to surprisingly large numbers for the cross section. The subsequent decay of $\rho^0(\omega^0) \rightarrow e^+(\mu^+) + e^-(\mu^-)$ is considered as a possible and interpretable correction to the pure quantum electrodynamic calculations of large angle pair production. The possibility of measuring the $\rho(\omega)\pi\gamma$ coupling constant is examined by considering the coherent process in the nuclear Coulomb field $\pi + A \rightarrow \rho(\omega) + A$. The question of whether vector boson production could give significant enhancement to secondary pion and kaon beams is considered. No confident theoretical statement can be made about this question, and a definite answer depends on the experimental determination of certain parameters. (auth)

9170 THREE-PION DECAY MODES OF ETA AND K MESONS AND A POSSIBLE NEW RESONANCE. Laurie M. Brown and Paul Singer (Northwestern Univ., Evanston, Ill.). Phys. Rev., 133: B812-17(Feb. 10, 1964).

A model that postulates a spin-zero T = 0 dipion, proposed earlier to explain an apparent enhancement of the three-pion decay mode of the η meson, is applied to obtain detailed predictions concerning the three-pion decays of the η and K mesons. Good agreement is found with all the available data on η and K spectra and branching ratios if the dipion mass and full width are taken as about 400 Mev and 75 to 100 Mev, respectively, thus providing positive evidence for the existence of a two-pion resonance reported by Samios. (auth)

9171 THEORY OF A CONFIGURATIONAL EMF. Marvin Chester (Univ. of California, Los Angeles). Phys. Rev., 133: A907-15(Feb. 17, 1964).

A configuration emf refers to an electrical manifestation in the electron gas of the analog of the Bernoulli effect for fluid flow. A theoretical account of this phenomenon is given. The object of the theory is to present a description of the effect from first principles that in this instance are taken as the Boltzmann transport equation. The transport equation is solved for a two-band (holes and electrons) Fermi particle system. The solutions are carried beyond first order so as to exhibit the effect. It is shown that the form of the emf is, indeed, extractable from the Boltzmann equation. Its magnitude is obtained in terms of a coefficient for which a formula is given in terms of familiar current carrier parameters. (auth)

9172 COMPARISON TO EXPERIMENT OF THE AMATIC-LEADER-VITALE MULTIPION-EXCHANGE CONTRIBUTIONS. Peter Signell (Pennsylvania State Univ., University Park). Phys. Rev., 133: B982-7(Feb. 24, 1964).

The phase shifts obtained by Amati, Leader, and Vitale (ALV), using the Cini-Fubini approach to the Mandelstam representation, are compared to proton-proton scattering data at 51.8, 96.5, 142, 210, and 310 Mev. The ALV phases yield a considerably better fit to the data than does pure one-pion exchange, but considerably poorer than modified phase analyses. The unusual behavior of the ALV $^3F_2$ and ϵ_4 is not confirmed. The lower angular momentum phases from ALV + data are generally not greatly different from those of modified phase analyses. (auth)

9173 PROTON-PROTON SCATTERING AT 970 Mev. D. V. Bugg (Cambridge Univ., Eng.), A. J. Oxley, J. A. Zoll, J. G. Rushbrooke, V. E. Barnes, J. B. Kinson, W. P. Dodd, G. A. Doran, and L. Riddiford. Phys. Rev., 133: B1017-31(Feb. 24, 1964).

Proton-proton scattering was studied at 970 Mev using a 1-Bev synchrotron and a 9-in.-diam. liquid-hydrogen bubble chamber; 3945 events were analyzed and cross sections determined for the various reactions. The elastic scattering cross section of 24.8 ± 0.9 mb is significantly

higher than the result of Dowell et al. using counters. The two experiments agree on the shape of the angular distribution, but not on its normalization; possible reasons for this are discussed. The elastic scattering angular distribution is peaked strongly forward, but does not agree quantitatively with pure diffraction. Polarization effects observed in the elastic scattering agree with previous and more accurate counter experiments. Inelastic scattering is strongly influenced by the $(^3/_2,^3/_2)$ π^+p resonance and the peripheral mechanism. Theoretical predictions based on the single-pion exchange model are compared in detail with the experimental results and good quantitative agreement is obtained for small momentum transfers, particularly for the reaction $p + p \rightarrow n + p + \pi^+$. Even for small momentum transfers, asymmetries in the Treiman-Yang test and departure from the expected $(1 + 3\cos^2\theta)$ $\pi^+ - P$ angular distribution indicate that other mechanisms may be important. The cross section for double-pion production at 970 Mev is less than 0.2 mb. (auth)

9174 CONSTRUCTION OF AMPLITUDES WITH MASSLESS PARTICLES AND GAUGE INVARIANCE IN S-MATRIX THEORY. Daniel Zwanziger (Istituto Nazionale di Fisica Nucleare, Rome and Università, Rome). Phys. Rev., 133: B1036-45(Feb. 24, 1964).

The fundamental statement of relativistic invariance for scattering amplitudes is that the amplitude remains invariant when the momentum and spin variables of each particle are transformed according to the corresponding irreducible, unitary representation of the inhomogeneous Lorentz group. To "construct an amplitude" is to find the most general function that has the required transformation properties. This construction, which had been previously effected for any number of massive particles of arbitrary spin, is extended to include massless particles of arbitrary spin as well. In the case of photons, the resulting formalism is compared with the usual one that makes use of transverse polarization vectors and a gauge-invariance condition. The two formalisms are proven to be equivalent. It is concluded that the gauge condition is superfluous as an independent physical principle for the purpose of constructing amplitudes. Its use in the conventional formalism is simply a way of imposing the Lorentz-transformation properties appropriate to massless particles. The known analogous construction for massive spin-one particles is shown to be equivalent to the usual formalism, and the requirement of Lorentz invariance is shown to be equivalent to the usual prescription for virtual photons as well. (auth)

9175 NEUTRINO ABSORPTION IN DENSE MATTER. Robert N. Euwema (Princeton Univ., N. J.). Phys. Rev., 133: B1046-53(Feb. 24, 1964).

Neutrino absorption in matter up to densities of 10^{15} g/cm^3 is discussed. The number density of neutrons, protons, and electrons in the degenerate matter is found. The effect of the Pauli Exclusion Principle on the absorption is then analyzed under the idealization of zero-temperature material composed of noninteracting nucleons. For example, the threshold neutrino energy, below which the degenerate matter is completely transparent to neutrinos, is found. The various results are presented in terms of tables, graphs, and simple equations. (auth)

9176 SEMIPHENOMENOLOGICAL SOLUTIONS OF PION-NUCLEON PARTIAL-WAVE DISPERSION RELATIONS. A. Donnachie and J. Hamilton (Univ. of London). Phys. Rev., 133: B1053-73(Feb. 24, 1964).

A variational method of solving $\pi - N$ partial-wave dispersion relations is developed. Analytic trial functions are used, and their parameters are varied to obtain a unitary solution. A good solution for the $(^3/_2, ^3/_2)$ resonance is obtained by using the Layson function. The shape of the resonance, as well as its position, is obtained. The only problem about the solution is the validity of the short-range interaction term that is used. Crossing of the real part of the amplitude verifies that it is accurate, but it is not obvious why the variation method should give such a good result. The explanation appears to be that in many cases the low-energy behavior of a partial wave is dominated by the long-range interactions, and a comparatively simple analytic function will give a good solution. An application of the variational method to confirm an earlier analysis of s-wave π-N scattering is also given. (auth)

9177 (PSEUDOSCALAR AND VECTOR EXCHANGES IN THE PRODUCTION OF VECTOR MESONS. Robert W. Huff (Univ. of California, Berkeley). Phys. Rev., 133: B1078-84(Feb. 24, 1964). (UCRL-11003; CONF-250-16)

The cross section for the general reaction (pseudoscalar meson + nucleon $\rightarrow$ spin-$^1/_2$ baryon + vector meson) and the decay angular distributions for the final baryon and vector meson are calculated under the assumption that the reaction is dominated by the exchange of pseudoscalar and vector mesons. The results are applied to an analysis of the reaction $\pi^- p \rightarrow \Sigma^0 K^{*0}$. (auth)

9178 HIGH-FREQUENCY REGION OF THE SPECTRUM OF ELECTRON AND POSITRON BREMSSTRAHLUNG. [PART] II. R. J. Jabbur and R. H. Pratt (Stanford Univ., Calif.). Phys. Rev., 133: B1090-1(Feb. 24, 1964).

The high-frequency limit of the bremsstrahlung spectrum from very high-energy electrons was calculated exactly with numerical methods. It is found that, even in the heaviest elements, only the s- and p-state partial waves of the outgoing zero-energy electron contribute significantly to the cross section: for Th(Z = 90) the s state gives 56% of the total and the p state 42%, while the d-state contribution is 2% and the f-state contribution 0.1%. It is also found that the s- and p-state cross sections are well represented by analytic expressions that were given previously. (auth)

9179 ELECTRON-PROTON SCATTERING AT HIGH MOMENTUM TRANSFERS. K. W. Chen, A. A. Cone, J. R. Dunning, Jr., S. G. F. Frank, N. F. Ramsey, J. K. Walker, and Richard Wilson (Harvard Univ., Cambridge, Mass.). Phys. Rev. Letters, 11: 561-4(Dec. 15, 1963).

The elastic electron-proton scattering cross section was measured at electron energies varied to attain q^2(4-momentum transfer squared in F^{-2}) = 45, 75, 100, and 125 F^{-2} for a 35° scattering angle and q^2 = 75 and 100 F^{-2} for a 70° scattering angle. An attempt was made to separate the proton electromagnetic form factors, assuming the validity of the first Born approximation. The results are consistent with $G_E = G_M$ at large momentum transfers and with a form factor decrease with momentum transfer increase. The data also are inconsistent with a core in either the electric or magnetic form factor. (D.C.W.)

9180 FINAL-STATE INTERACTIONS IN THE DECAY $H \rightarrow 3\pi$. Frank S. Crawford, Jr. (Univ. of California, Berkeley), Ronald A. Grossman, L. J. Lloyd, LeRoy R. Price, and Earle C. Fowler. Phys. Rev. Letters, 11: 564-7(Dec. 15, 1963). (UCRL-11075)

The results of an analysis of the Dalitz-Fabri plot of 97 $\eta \rightarrow \pi^+ + \pi^- + \pi^0$ decays are presented. The etas were produced in the interaction $\pi^+ + p \rightarrow \pi^+ + p + \eta$ at 1170 and 1050 Mev/c. Comparisons show that the data are in only fair agreement with the linear matrix element theories and are in excellent agreement with the I = 0, I = 0 di-pion resonance hypothesis of Brown. (D.C.W.)

9181 TRANSVERSE MOMENTUM DISTRIBUTION OF PROTONS IN p-p ELASTIC SCATTERING. Jay Orear (Cornell Univ., Ithaca, N. Y.). Phys. Rev. Letters, 12: 112-13(Jan. 27, 1964).

It is shown that previously determined p-p elastic scattering cross sections that range in energy from 10 to 30 Bev and momentum transfer squared from 3 to 25 $(Bev/c)^2$ can be fit by a single exponential in transverse momentum. This exponential is the same one that describes the transverse momentum distributions of mesons (π) produced in nucleon-nucleon interactions. (C.E.S.)

9182 LARGE ANGLE p-p ELASTIC SCATTERING AT 30 Bev. W. F. Baker (Brookhaven National Lab., Upton, N. Y.), E. W. Jenkins, A. L. Read, G. Cocconi, V. T. Cocconi, A. D. Krisch, J. Orear, R. Rubstein, D. B. Scarl, and B. T. Ulrich. Phys. Rev. Letters, 12: 132-3 (Feb. 3, 1964).

Differential cross sections were obtained for p-p elastic scattering at 30 Bev. The highest momentum transfer achieved was 24.4 $(Bev/c)^2$ at a center-of-mass scattering angle of 82.4°. (C.E.S.)

9183 ENHANCEMENT OF THE $\pi K\overline{K}$ INTERACTION. R. J. Oakes (Stanford Univ., Calif.). Phys. Rev. Letters, 12: 134-6(Feb. 3, 1964).

One-pion-exchange scattering of $\overline{K}$ on K* is investigated. Peierl's mechanism is applied to the $\pi K\overline{K}$ system, and the possible relevance to the recently reported peak observed in the $\pi K\overline{K}$ mass spectrum around 1410 Mev is discussed. (C.E.S.)

9184 SYMMETRY CHARACTERISTICS OF BLOCH ELECTRON IN A MAGNETIC FIELD. H. J. Fischbeck (Inst. of Physics and Tech., German Academy of Sciences, Berlin). Phys. Status Solidi, 3: 2399-2409(1963). (In German)

The symmetry transforms for the Hamiltonian of a Bloch electron in a magnetic field were investigated, using a gage-independent formulation. On the assumption that the magnetic field is "rational" with respect to its magnitude and direction, simultaneous eigenfunctions were constructed for the Hamiltonian and all commuting symmetry-operators. The energy degeneracy of these wave functions involves a periodicity of their energy spectrum. (auth)

9185 RADIATIVE CORRECTIONS TO COMPTON SCATTERING. BREMSSTRAHLUNG AND PAIR PRODUCTION AT HIGH ENERGIES. Kjell J. Mork. Proc. Phys. Seminar Trondheim, No. 7, 1-133(1963).

Radiative corrections to the total cross section for Compton scattering of unpolarized, high-energy photons on electrons are computed to first order in the fine-structure constant, α. A differential and a total cross section of the same order were obtained for high-energy double Compton scattering in which one of the emitted photons has an energy small compared to the energy of the incident photon in the center-of-mass system. First order in α corrections to the bremsstrahlung and pair production energy spectra were calculated in the Weizsäcker-Williams approximation. Bremsstrahlung and pair production with the emission of an additional photon are included, the energy of the additional photon being much smaller than the energy of the primary particle. The effect of these corrections on the pair production total cross section is also evaluated. Numerical results are given. (auth)

9186 A COVARIANT POLARIZATION OPERATOR FOR s = 1 PARTICLES. H. Hoegaasen (Institutt for Teoretisk Fysikk, N.T.H., Trondheim, Norway). Proc. Phys. Seminar Trondheim, No. 10, 1-8(1963).

A covariant spin projection operator corresponding to the 4-vector operator of Michel and Wightman is derived for vector particles. (auth)

9187 BROKEN SYMMETRIES AND COUPLING CONSTANTS. Keiji Kikkawa (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 30: 636-46(Nov. 1963).

Under the assumption that the symmetry violation in the SU_3-octet model comes from the mass terms of baryons and mesons, the shifts of the coupling constants among the particles from the symmetric values are estimated. The vector mesons (ρ, ω, and K*) reduce the coupling constant $g^2_{KN\Lambda}$ compared with $g^2_{\pi NN}/3$, while the p-s mesons (π, η, and K) enhance it. (auth)

9188 ANALYTICITY OF THE PRODUCTION AMPLITUDE IN THE HIGHER ORDER DIAGRAM. Jun Otokozawa (Tohoku Univ., Sendai), Naohiko Masuda, and Miwae Yamazaki. Progr. Theoret. Phys. (Kyoto), 30: 647-56(Nov. 1963).

Partial-wave s-singularity of the production amplitude is analyzed in the cases of $\pi + N \rightarrow 2\pi + N$ and $2\pi + N \rightarrow 2\pi + N$. It is shown that the complex singularities of the fourth-order diagram coincide completely with those obtained from the corresponding pole diagram. Although the left-hand and right-hand singularities simultaneously appear on some region of the s-t plane, they are shown to be separated unambiguously. Detailed discussions about more general diagrams are also made and similar results are obtained. (auth)

9189 MEASUREMENT OF SPIN CORRELATION COEFFICIENTS IN p-p SCATTERING AT 52 Mev. Keigo Nisimura, Junpei Sanada, Philippe Catillon, Kiyoji Fukunaga, Takeo Hasegawa, Hiromi Hasai, Norio Ruy, D. C. Worth, and Hitoshi Imada (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 30: 719-20(Nov. 1963).

The methods and results of spin correlation coefficient C_{nn} measurements for p-p interactions at 52 Mev at 90° in the C.M. system are discussed. (R.E.U.)

9190 SYMMETRY PROPERTIES OF NONLEPTONIC BARYON-DECAY INTERACTIONS IN UNITARY-SYMMETRIC SPURION FORMALISM. Kanji Fujii and Daisuke Itô (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), 30: 720-2(Nov. 1963).

A general form of the nonleptonic decay interactions of strongly interacting particles is constructed in a formally unitary-symmetric way by using the spurion technique in octet form. The symmetry properties of the interactions are investigated. Spurions carrying hypercharge ±1, isotopic spin $\frac{1}{2}$, and no charge are written as matrices in the tensor representation of the unitary group, and this automatically leads to $|\Delta I| = \frac{1}{2}$ rule. Invariance is required under generalized space inversion. (R.E.U.)

9191 NOTE ON THE K* (730 Mev). Shigeo Minami (Louisiana State Univ., Baton Rouge). Progr. Theoret. Phys. (Kyoto), 30: 722-4(Nov. 1963).

It is shown that even if there is no evidence for the decay process $K^*(885) \rightarrow K^*(730) + \pi$, this is not necessarily inconsistent with the assumption of vector K*(730). The determination of K*(730) spin is discussed. 15 references. (R.E.U.)

9192 $\Delta S/\Delta Q$ RULE AND K_{l4} DECAY. Shigeru Machida (Rikkyo Univ., Tokyo). Progr. Theoret. Phys. (Kyoto), 30: 724-5(Nov. 1963).

The conservation of $\Delta S = \Delta Q$ selection rule in all K_{l4} decays, $K^+ \rightarrow \pi^+ + \pi^- + e^+ + \nu$, is shown to be a necessary theoretical conclusion. The conclusion is a direct consequence of assuming the doublet- and K-spins to be more important than isotopic spin. (R.E.U.)

9193 ON THE THEORETICAL INTERPRETATION OF 3-3 RESONANCE IN π-N SCATTERING. Takeshi Kanki and Hiroyuki Yokomi (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), 30: 725-7(Nov. 1963).

The conclusion that the contribution from the pole diagram in the crossed channel gives an attractive short-range force is studied, and a further conclusion is given. New variables, pion laboratory energy (ω) and $S = M^2 + 2M\omega + 1$, are used to avoid the d-wave contribution related to the left-hand cut in W-plane. A higher mass resonance is found to be necessary for more accurate calculations of the N- and D-functions. (R.E.U.)

9194 POSSIBLE EXISTENCE OF A NEUTRINO WITH MASS AND PARTIAL CONSERVATION OF MUON CHARGE. Masami Nakagawa (Nagoya Univ., Japan), Hisaichiro Okonogi, Shoichi Sakata, and Akira Toyoda. Progr. Theoret. Phys. (Kyoto), 30: 727-9(Nov. 1963).

A modified baryon−lepton (B-L) symmetry in the weak interactions was established, and the true neutrinos ν_1 and ν_2 were postulated as $\nu_e = \cos\alpha \cdot \nu_1 - \sin\alpha \cdot \nu_2$ and $\nu_\mu = \sin\alpha \cdot \nu_1 + \cos\alpha \cdot \nu_2$, where α is a real constant. Nuclear beta decays are discussed considering ν_1 and ν_2. (R.E.U.)

9195 ISOSCALAR ELECTROMAGNETIC STRUCTURE OF THE NUCLEON. Ken Kawarabayashi (Tokyo Univ.) and Akira Sato. Progr. Theoret. Phys. (Kyoto), Suppl., No. 21, 3-70(1962).

A review of investigations on the three-pion state contribution to the isoscalar electromagnetic structure of the nucleon with the inclusion of the effects of multi-pion resonances, is presented. (auth)

9196 EFFECTS OF THE PION-PION INTERACTION ON PHOTONUCLEAR REACTIONS. Masaaki Kawaguchi and Hiroyuki Yokomi (Osaka Univ.). Progr. Theoret. Phys. (Kyoto), Suppl., No. 21, 71-119(1962).

Various effects of the pion-pion interaction on the photonuclear reactions through the phenomenological γ-3π interaction are investigated. Processes discussed here are pion photoproduction, double pion photoproduction, and electromagnetic properties of the deuteron. The following problems are investigated in detail: angular distribution, polarization of the recoil proton, photopion with polarized gamma rays, for neutral pion photoproduction; and plus-minus ratio of charged pion photoproduction, double pion photoproduction. For the electromagnetic properties of the deuteron, magnetic moment, electric quadrupole moment, and photodisintegration are studied. The effective γ-3π hamiltonian is given, and appropriate approximation is made for the I = J = 1 pion-pion resonance in the matrix elements of photoprocesses. These approximations often lead to overestimation of the effects, as is criticized. (auth)

9197 PHENOMENOLOGICAL THEORIES OF ELEMENTARY PARTICLE RESONANT STATES. Shigeo Minami (Louisiana State Univ., Baton Rouge). Progr. Theoret. Phys. (Kyoto), Suppl., No. 21, 120-37(1962).

Recent experiments have shown various remarkable results not only for decay but also phenomenological theories for production of elementary particle resonant states. (auth)

9198 CONSEQUENCES OF A SIMPLE MODEL FOR TWO-CHANNEL REACTIONS IN FIELD THEORY. Yasunori Fujii (Nihon Univ., Tokyo) and Masayuki Uehara. Progr. Theoret. Phys. (Kyoto), Suppl., No. 21, 138-74 (1962).

A simple model for two-channel reactions in field theory is proposed, that satisfies Lorentz invariance, unitarity, and causality. Its consequences are examined extensively to make a classification of resonances. (auth)

9199 INVESTIGATION OF THE CORRELATION BETWEEN RESONANCE EFFECT AND NEAR THRESHOLD EFFECT IN THE $\pi + p \rightarrow \Lambda + \pi + K$ REACTION. Zhaobin Su, Chong-shou Gao, and Kuang-chao Chou. Wu Li Hsueh Pao, 19: 649-72(Oct. 1963). (In Chinese)

An experiment for the reaction $\pi + p \rightarrow \Lambda + \pi + K$ is proposed. The total energy in the center of mass system is fixed at 1900 Mev. The kinetic energy of the final K meson is then in the range 0 to 90 Mev. It is proposed to observe the final state $\Lambda - \pi$ resonance and the cusp at the $\Sigma\pi K$ threshold. From the correlation between the resonance and the cusp and from the angular distribution of the resonance, the spin of Y_1^* and the relative parities among Y_1^*, Λ, and Σ may be determined. Based on the diagonal representation of T-matrix in the channel space, a general phenomenological description of the resonance effect, the near-threshold effect, and the final-state interaction is developed that takes into account especially the correlation of the cusp with a nearby resonance. The general theory is applied to the experiment as a special case. (auth)

9200 INVESTIGATIONS OF $\pi-\pi$ RESONANCES IN π^-−p INTERACTIONS AT 3.5 Bev/c INITIAL π^- MESON MOMENTUM. M. S. Ainutdinov, S. M. Zombkovskii, Ya. M. Selektor, and V. N. Shulyachenko (Inst. of Theoretical and Experimental Physics, USSR). Zh. Eksperim. i Teor. Fiz., 45: 1682-4(Oct. 1963). (In Russian)

A 25-cm hydrogen bubble chamber was used in an investigation of ~8000 $\pi^- + p \rightarrow \pi^- + \pi^0 + p$ and $\pi^- + p \rightarrow \pi^- + \pi^+ + n$ reactions with initial π^- momenta of 3.5 Bev/c. Two-prong stars with tracks <3 cm were processed using an automatic measuring device. Proton tracks were measured for the first reactions. Distributions according to effective masses for $\pi^--\pi^0$ and $\pi^+-\pi^-$ systems were plotted. The mas distributions of $\pi^--\pi^0$ were constructed for the 4-momentum $\Delta^2 < (200\ Mev/c)^2$ events. The errors in determining $\pi^+-\pi^-$ were ~60 Mev for M_{eff} = 760 Mev and ~80 Mev for M_{eff} = 1200 Mev. A clear maximum corresponding to ρ^- production was observed for $\pi^--\pi^0$ effective mass distribution at M_{eff} = 770 Mev, and two maxima corresponding to ρ^0 and f^0 production were observed for $\pi^+-\pi^-$. An attempt was made to determine the spin of the f^0 meson. The angular distributions of π^- mesons with dipion center-of-mass distributions of 900 to 1100, 1100 to 1400, and 1400 to 1800 Mev indicate that in the f^0 mass range (1100 to 1400 Mev) the distribution was anisotropic and the f^0 spin S > 0. (R.V.J.)

9201 CHARGE EMISSION FROM A MOVING LAYER IN A DIELECTRIC. L. G. Naryshkina (Moscow Inst. of Engineering Physics). Zh. Tekhn. Fiz., 33: 1318-22(Nov. 1963). (In Russian)

Studies were made of Vavelov-Cherenkov radiation emitted by a charged particle moving in a dielectric. Equations were obtained for the radiation field and energy. It was found that a dielectric layer has focusing properties under certain conditions. (tr-auth)

9202 THE PRODUCTION OF HEAVY VECTOR MESONS BY NEUTRINOS. G. von Gehlen. Thesis, Karlsruhe, Technische Hochschule, 1962. 35p. $2.00 (Gmelin, AED-DISS. 62-557)

The total cross section for the reaction neutrino + nucleon = W + e^- + nucleon is calculated using the rules of Feymann-Dyson perturbation theory. It is assumed that the vector boson W is responsible for the weak interactions. W and e^- are produced in the electromagnetic field of the nucleon. After summation over spins and polarizations, one analytical integration over the final states is possible. The residual 2 integrations were

made with a computer ZUSE Z 23 for boson masses of 0.6 and 1.2 Bev and neutrino energies below 6 and 24 Bev. The cross section is, for 24 Bev and for a boson mass 1.2 Bev, of the order of 10^{-36} cm^2. The cross sections for Cu^{63} for neutrino energies up to 900 Bev are given. (Gmelin Inst.)

9203 ANALYTICAL PROPERTIES OF THE AMPLITUDE FOR THE SCATTERING OF π MESONS BY K MESONS. Yong-son Jin. Thesis, Hamburg, Universität, 1962. 27p. $2.00(Gmelin, AED-DISS 62-547)

Using the method of Mandelstam, analytical properties of π-k scattering amplitudes are studied as functions of total energy and momentum transfer. Dispersion relations for several meson interaction processes and Lehmann ellipses in all three channels are given. An extension of Mandelstam's method for the scattering of two particles with different masses is developed. (Gmelin Inst.)

9204 MULTIPLE PION PRODUCTION AT 2.0 Bev. Paul Ralph Satterblom. Thesis, Madison, Wis., Univ. of Wisconsin, 1963. 101p.

A study of pion-proton interactions in a liquid H bubble chamber is reported. A 2.1 Bev/c negative pion beam incident upon a 14 in. dia. chamber caused interactions, from which those with 4 charged secondaries were selected and measured. Fits were attempted to the following final states: $3\pi + P$, $3\pi + P + \pi^0$, and $4\pi + n$. By normalizing to a total cross section of 35.7 mb, the partial cross sections for the above listed final states are found to be 1.67 ± 0.08, 1.17 ± 0.06, and 0.37 ± 0.02 mb. The $3\pi + P$ reaction was found to be dominated by the production of the 3/2-3/2 pion nucleon isobar. The cross section for this process is 0.53 ± 0.05 mb. Evidence for the eta and omega mesons was found in the $3\pi + P + \pi^0$ final state. Their cross sections are 0.037 ± 0.015 and 0.26 ± 0.035 mb, respectively. A Dalitz plot for eta decays is presented. Evidence is given for a double peak in the neutral 2-pion mass spectrum for $3\pi + P$ events. The peaks coincide with those attributed to the rho meson in other experiments. An attempt is made to calculate the pion-pion cross section by isolating events with low momentum transfer to the isobar. (Dissertation Abstr.)

9205 K^+-MESON NEUTRON SCATTERING AND FOUNDATIONS OF QUANTUM THEORY. (PARTS I AND II). Robert Edward Budwine. Thesis, College Station, Tex., Agriculture and Mechanical Coll., 1963. 56p.

In part I, the problem of positive kaons scattering from neutrons is considered using the techniques of Feynman diagrams. It is assumed that the scattering takes place by direct interaction so that the Feynman diagram is analogous to that of Compton scattering. It is also assumed that the intermediate state particle has to be one of the known elementary particles and that all attributes are conserved at the vertices. In non-charge exchange scattering the intermediate state particle must be the Σ^- hyperon. The conservation laws restrict the possible Feynman diagrams to the "exchange" diagram. In charge exchange scattering there are 2 possible intermediate state particles, the Σ^0 hyperon and the Λ hyperon. If the kaon is a pseudoscalar particle it may interact by either the pseudoscalar or pseudovector coupling. It is assumed that the Σ hyperons are pseudoscalarly coupled and the Λ's through the pseudovector. These assumptions then lead to differential and total cross-sections that are in good agreement with the available experimental data. The differential cross-section for non-exchange is isotropic in the center of mass system, while for charge exchange it is peaked backwards in the center-of-mass system. The total cross-section for non-exchange is approximately constant with energy and rather strongly increasing with energy for charge exchange. In part II, the standard results of quantum mechanics are obtained using familiar mathematics and the postulate: "To every infinitesimal canonical transformation of classical mechanics there corresponds an infinitesimal unitary transformation of quantum mechanics such that the generator of the unitary transformation is the same as the generator of the canonical transformation." (M.P.G.)

9206 A RESONANCE MODEL FOR THE PHOTOPRODUCTION OF K-MESONS. Nicholas Anthony Beauchamp. Thesis, Nashville, Vanderbilt Univ., 1963. 118p.

A resonance model for the reaction $\gamma + N \rightarrow K + \Lambda$ is presented. The model is introduced within a framework that is valid for the more general reaction $\gamma + N \rightarrow K + Y$. This generality is obtained through use of the Mandelstam representation to effect a justification of the model used. Only those contributions from the N, K, K*, and the $p_{1/2}$ nucleon resonance of Kanazawa are considered. This resonance contributes only through the M_{1-} multipole eigenamplitude and a Breit-Wigner form for it is assumed: $M_{1-} = [(k\,q\,H)/(s-s_0) + i(\Gamma/2)]$ where s_0 and $(\Gamma/2)$ are chosen to represent a resonance at 1718 Mev with a full width of 120 Mev. The unknown parameters that enter the model are: g_{NAK}, the coupling constant at the N-Λ-K vertex; $g^{(1)}_{NAK*}$ and $g^{(2)}_{NAK*}$, the coupling constants at the N-Λ-K* vertex; $F^{(S)}$ and $F^{(V)}$, the isoscalar and isovector form factors at the γ-K-K* vertex; and H, the "height" of the resonance. Expressions for the differential cross section and the Λ polarization are obtained within the framework of the resonance model. The parameters that enter the model are then evaluated by fitting the experimental data for the process $\Lambda + p \rightarrow \Lambda^0 + K^+$. The best fit occurs for the following choice of parameters, where $C_1 = (F^{(S)} + F^{(V)})\,(g^{(1)}_{NAK*}/g_{NAK})$: $C_1 = 1.0\ (Bev)^{-1}$; $C_2 = 0.40\ (Bev)^{-2}$; $H = .006\ (Bev)^{-1}$; and $(g^2_{NAK}/4\pi) = 5.8$. (Dissertation Abstr.)

9207 GEOMETRIC CALCULUS AND ELEMENTARY PARTICLES. David Orlin Hestenes. Thesis, Los Angeles, Univ. of California, 1963. 179p.

Using Clifford algebra, a coordinate-free geometric calculus for non-Euclidean metric manifolds is developed, in which vectors and spinors appear on equal footing. A simple generalized covariant derivative is introduced, which applies to both vectors and spinors. Gravitational interactions arise from requiring covariance of the derivative under a local gauge group of Lorentz transformations. The Clifford algebra D_4 of space-time is examined in detail, and a geometric basis for isospace is found. Fermions are represented by ideals of D_4. Complex numbers arise naturally, and it follows that a geometric interpretation can be given to antiparticle conjugation. Several invariant kinds of "conjugation" in D_4 are found, and their possible physical interpretations are examined in terms of specific models for physical interactions. A model of weak interactions mediated by bosons is examined, in which the asymmetry parameters of hyperon decay are related to a cancellation of amplitudes that change the strangeness of a system by 2. (Dissertation Abstr.)

9208 CHARGE SYMMETRY OF K^+ AND K^0 MESONS IN ASSOCIATED PRODUCTION. Arthur Zoltan Kovacs. Thesis, Durham, N. C., Duke Univ., 1963. 56p.

A test of charge symmetry of K^+ and K^0 mesons was made by comparing π^+ and π^- interactions at 1.23 Bev/c in a 72 in. deuterium bubble chamber. 132 interactions of the type $\pi^+ + d \rightarrow \Lambda^0$ (or Σ^0) $+ K^+ + p$, and 132 interac-

tions of the type $\pi^- + d \rightarrow \Lambda^0$ (or Σ^0) + K^0 + n were compared. The total cross sections and their ratio were measured to be: $\sigma(\pi + d \rightarrow P\Lambda\,{}^0K^+) = 0.71 \pm 0.07$ mb; $\sigma(\pi - d \rightarrow n\Lambda\,{}^0K^0) = 0.67 \pm 0.07$ mb; and $R(P\Lambda\,{}^0K^+/n\Lambda\,{}^0K^0) = 1.06 \pm 0.14$. The differential cross sections in the fictitious center of mass frame of the π and stationary nucleon were also calculated. The lambda decay asymmetries were measured to be $\alpha_\Lambda \overline{P}_\Lambda = 0.53 \pm 0.15$ for the Λ^0K^+ final state and $\alpha_\Lambda \overline{P}_\Lambda = 0.17 \pm 0.17$ for the Λ^0K^0 final state. Comparison of the total cross sections, momentum spectra, angular distributions, differential cross sections, and lambda polarizations gave no evidence for deviations from charge symmetry. (M.P.G.)

9209 PI MINUS INTERACTIONS IN PROPANE NEAR THE SECOND RESONANCE. John Harvey Scandrett. Thesis, Madison, Wis., Univ. of Wisconsin, 1963. 107p.

A 12 in. propane bubble chamber was exposed to π^- mesons from the Brookhaven Cosmotron. Pictures at 600 and 770 Mev were analyzed for interactions in H and C. Careful attention was paid to quasi-elastic C contamination in the π^- + p differential elastic cross sections. Total cross sections for π^- + p → π^0 + n, $\pi^+ + \pi^-$ + n, $\pi^0 + \pi^-$ + p, and $\pi^0 + \pi^0$ + n are estimated for the H interactions, normalized to total π^- − p and π^- − C cross sections from counter experiments. The results are presented. C interactions were tabulated as to prong distribution, and π^- − C elastic scattering was compared with predictions of the optical model, using no adjustable parameters. Semi-quantitative π^--neutron differential scattering cross sections were obtained, giving information about the T = 3/2 state at these energies. The γ-ray angular distribution from charge exchanges at 460 Mev was analyzed and used to test the forward dispersion relations. A complete phase shift analysis was attempted, including D waves at 600 Mev and F waves at 770 Mev. The results, while not decisive owing to the great number of parameters, are that no single state appears to pass through a resonance at 600 Mev. There is absorption in many states, with strong absorption in S_{11}, S_{31}, P_{11}, D_{13} at 600 Mev, and in S_{11}, S_{31}, P_{13}, D_{13} at 770 Mev. (Dissertation Abstr.)

9210 ON THE THEORY OF MULTIPLE SCATTERING. N. P. Kalashnikov. p.130-4 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

A multiple scattering dispersion relation was developed. An expression was also found for double Coulomb scattering on various atoms. (tr-auth)

9211 THE ROSENBLUTH FORMULA. D. R. Yennie (Univ. of Minnesota, Minneapolis). 17p. (CONF-122-20)

From International Conference on Nucleon Structure, Stanford, Calif., June 1963.

The Rosenbluth formula, defined as the theoretical expression for the differential cross section for electron-proton scattering under one-photon-exchange, is discussed. Electron-proton and positron-proton scattering are compared using the formula. Some possible corrections to the Rosenbluth formula are discussed. The effects of non-electromagnetic interactions and two-photon-exchange, with the possibility of Regge pole behavior, are also discussed. (R.E.U.)

9212 ANNIHILATION SPECTRUM OF POSITRONS IN FLIGHT FROM A THICK TARGET. R. V. Elliott and L. Katz (Univ. of Saskatchewan, Saskatoon). 6p. (CONF-250-14)

From American Physical Society, 1963 Summer Meeting, Edmonton, Can., Aug. 1963.

Positron annihilation in flight in a LiH target produces a photon spectrum of narrow energy spread. A method is developed for calculating the shape of the photon spectrum. (C.E.S.)

Field Theory and Quantum Mechanics

9213 (UR-875-11(p.251-73)) A POSSIBLE CONNECTION BETWEEN LORENTZ SPACE AND ISOTOPIC SPIN SPACE. D. Lurie (Rochester, N. Y. Univ.).

A formalism that might be used to investigate the connection between isotopic spin space and Lorentz space is presented. (D.C.W.)

9214 (UR-875-11(p.274-93)) GAUGE-INVARIANT AND GAUGE-COVARIANT GREEN'S FUNCTIONS. I. Bialynicki-Birula (Warsaw. Univ. Inst. of Theoretical Physics).

The functional integration formalism is used to obtain a formulation of quantum electrodynamics with gage dependent Green functions. A simple connection between this gage covariant formulation and Mandelstam's gage invariant formulation is established. Also, it is proved that the S-matrix in the Coulomb gage is the same as the S-matrix in the Feynman gage. (D.C.W.)

9215 (UR-875-11(p.345-74)) ASPECTS OF EUCLIDEAN FIELD THEORY AND FEYNMAN PATH INTEGRALS. K. Symanzik (New York Univ., New York).

The solution of Euclidean quantum field theory (EQFT) in terms of the Wiener history integral is described. A modified EQFT is formulated from the Minkowski quantum field theory. It is shown that even from this necessarily modified theory information can be obtained on the original theory. (D.C.W.)

9216 (UR-875-11(p.411-21)) AN UNCONVENTIONAL VIEW OF PERTURBATION EXPANSIONS. A. Ramakrishnan (Institute for Mathematical Sciences, Madras).

An unconventional approach to perturbation expansions for a quantum mechanical collision, standing between the old-fashioned perturbation theory and the Feynman formalism, is described. The Feynman operator is split into positive and negative energy parts. (D.C.W.)

9217 APPLICATION OF PERTURBATION THEORY TO THE STUDY OF A BOSE LIQUID AT ABSOLUTE ZERO. Jean Gavoret (Laboratoire de Physique Théoreque des Hautes Énergies, Orsay, France and Ecole Normale Supérieure, Paris). Ann. Phys. (Paris) (13), 8: 441-91(July-Aug. 1963). (In French)

A diagrammatic technique is developed for studying the elementary excitation spectra of liquid helium at 0°K. Quantum field theoretical methods are used. A "microscopic" calculation is made that reproduces the phenomenological spectrum. The diagrammatic technique permits summations to be made, in certain limiting cases, over all the developed perturbations. The He is assumed to be a Bose liquid. (T.F.H.)

9218 CAN HIDDEN VARIABLES BE EXCLUDED IN QUANTUM MECHANICS? J. M. Jauch (Université, Geneva and CERN, Geneva) and C. Piron. Helv. Phys. Acta, 36: 827-37(1963).

The question of the possible existence of hidden variables is re-examined. It is shown that hidden variables can exist only if every proposition (yes-no experiment) is compatible with every other one. It is further shown that this property is in contradiction with empirical facts. The

theorem that leads to this conclusion is a strengthening of the theorem of von Neumann on the same subject. The question is raised whether there exist quantum mechanical systems that admit approximate dispersion-free states. (auth)

9219 ON THE QUANTUM THEORY OF WAVE FIELDS. B. L. van der Waerden (Universität, Zürich). Helv. Phys. Acta, 36: 945-62(1963). (In German)

Along the lines indicated by V. Fock and K. Friedrichs, a rigorous foundation of field quantum theory is presented. A scalar boson field, the electron-positron field, the neutrino field, and the electro-magnetic field are considered. (auth)

9220 ON THE MOTION OF A CHARGED PARTICLE UNDER THE ACTION OF RECTANGULAR PULSES OF A MAGNETIC FIELD. B. A. Aničin (Inst. of Nuclear Science "Boris Kidrich," Belgrad). J. Nucl. Energy, Pt. C, 5: 341-4(Nov.-Dec. 1963).

An analysis of the motion of a charged particle under the action of rectangular pulses of a magnetic field is given. The stability of the motion is investigated, and a stability chart is derived. The energy gain per cycle in the unstable case is determined. It is proved that in the unstable case the ratio of the complex velocity to the complex position after a period of the magnetic field is asymptotically a constant independent of the initial conditions. (auth)

9221 GRAVITATIONAL RADIATION AND ABERRATED CENTRIPETAL FORCE REACTIONS IN G. D. BIRKHOFF RELATIVITY THEORY. PART ONE. RETARDED GRAVITATIONAL INTERACTION FORCES. James Clark Keith (Univ. of Detroit). J. Math. Phys., 42: 248-62(Sept. 1963).

The time rate of change of a point particle's kinetic energy due to gravitational interactions is calculated, together with the energy loss of a rotating mass ring due to interaction with its own gravitational field. The complete g-reaction between two spinning mass points is then obtained, and some examples of retarded gravitational reaction between two mass points are considered. Energy dissipation equations are also derived taking into account the balance of gravitational forces in a rotating system of gravitationally interacting particles. Their applicability to astronomical binaries is considered. (D.C.W.)

9222 ON MICROCOVARIANCE AND MICROCAUSALITY. Yu. M. Shirokov (Moscow State Univ.). Nucl. Phys., 46: 617-38(Sept. 1963).

General conditions of microcovariance reflecting the pseudo-euclidean properties of space-time at any distance, however small, are obtained for the relativistic quantum theory. The microcausality conditions suitable for particles with internal structure are formulated. Only general quantal principles and geometrical space-time properties are used in deriving these conditions. A new class of physical quantities named dynamical momenta is introduced. It is shown that dynamical momenta are the most convenient quantities for describing relativistic processes since they ensure a complete description, exist at each moment of time, and are asymptotic integrals of motion, i.e., tend to definite limits for infinite time. The dynamical momenta are used to establish the connection of the quantities for which the microcovariance and microcausality conditions are written with the elements of the S-matrix. It is essential that no postulates of quantum field theory are used. It is also shown that the existence of the hamiltonian description follows from the existence of the S-matrix and pseudo-euclidean space-time. The relations obtained open possibilities for deriving new connections between the elements of the S-matrix for different processes as well as formulating the problem of experimental investigation of the limits of applicability for the current conception of space-time structure. (auth)

9223 TRILINEAR COMMUTATION RELATIONS BETWEEN FIELDS. H. Scharfstein (New York Univ., New York). Nuovo Cimento (10), 30: 740-61(Nov. 1, 1963).

A set of trilinear equal-time commutation relations is derived from Schwinger's Action Principle under the assumption that for equal times the field variations commute with bilinears of field operators. Some consequences of these trilinear equal-time commutation relations are investigated, and representations of the operators that satisfy them are considered. (auth)

9224 ON THE INEQUIVALENT REPRESENTATIONS OF CANONICAL COMMUTATION RELATIONS IN QUANTUM FIELD THEORY. W. Weidlich (Universität, Berlin). Nuovo Cimento (10), 30: 803-29(Nov. 1, 1963).

The theory of inequivalent representations of canonical commutation relations is used to determine the connection between asymptotic fields and interpolating fields in relativistic theory. This connection is given by "pseudounitary operators," which are calculated perturbation-theoretically. The relation of these results to nonrelativistic formal scattering theory is discussed. (auth)

9225 SPIN CONNECTION IN TERMS OF DIRAC OPERATORS. H. G. Loos (Giannini Scientific Corp., Santa Ana, Calif.). Nuovo Cimento (10), 30: 901-5(Nov. 1, 1963).

A derivation is given for the expression of the spin connection in terms of the Dirac operators, using the Hamilton-Cayley theorem, modified for singular operators. (auth)

9226 COHERENCE THEORY OF THE ELECTROMAGNETIC FIELD. B. Karczewski (Univ. of Rochester, N. Y.). Nuovo Cimento (10), 30: 906-15(Nov. 1, 1963).

A generalization of the definition of the degree of coherence of a wave field is proposed that is applicable to any quasimonochromatic stationary electromagnetic field. This electromagnetic degree of coherence, which is a single scalar quantity, is introduced from the analysis of an interference experiment and it is shown to be related to the trace of the correlation tensor of the electric field introduced in 1954. (auth)

9227 PERTURBATION THEORY AND NONANALYTICITY IN THE COUPLING CONSTANT IN A FIELD-THEORETICAL MODEL. F. Calogero (Università, Rome and Instituto Nazionale di Fisica Nucleare, Rome). Nuovo Cimento (10), 30: 916-30(Nov. 1, 1963).

A simple field-theoretical model is shown to provide an explicit example of the existence of solutions that are nonanalytic in the interaction strength and are unattainable through perturbation theory. (auth)

9228 EXTERNAL SOURCES IN GAUGE THEORIES. D. G. Boulware and S. Deser (CERN, Geneva). Nuovo Cimento (10), 30: 1009-19(Nov. 16, 1963).

The notion of prescribed external sources is discussed for gauge fields. Such sources necessarily obey conservation laws that generally involve the fields themselves. The implications of these conservation requirements are analyzed for classical and quantized vector multiplets (such as the Yang-Mills field) and for (classical) general relativity. A number of the vector source components may be prescribed independent of the field. The remaining components are those coupled to the gauge parts of the field and may be eliminated by a suitable choice of gauge. On the other hand, although the gravitational conservation laws also leave a number of source components unconstrained,

the rest depend nonlocally in time on the gravitational field variables. It is shown that these nonlocal components cannot be eliminated from the theory by a choice of co-ordinate frame (gauge), and it is therefore concluded that external gravitational sources are not useful in analyzing the field's properties. (auth)

9229 ON PARASTATISTICS. A. Galindo (CERN, Geneva) and F. J. Yndurain. Nuovo Cimento (10), 30: 1040-7(Nov. 16, 1963).

A negative answer is given to the question whether it is possible or not to describe interesting parafields of rank $r > 1$ in terms of destruction and creation operators obtained from the Fock unsymmetrized ones by using special sequences of central idempotents. More specifically, it is proved for such algebras that no commutation relations exist that allow one to write state vectors in an almost normal form and that it is not possible to express the particle number operator N_k as a polynomial in certain suitable operators. (auth)

9230 POSSIBLE EXISTENCE OF A HEAVY PHOTON (Γ^0). D. Leiter (Brandeis Univ., Waltham, Mass.). Nuovo Cimento (10), 30: 1245-53(Dec. 1, 1963).

The Lehmann spectral form of the complete Green's function for the photon field is studied in the Heisenberg picture of quantum electrodynamics. Examination of the analytic properties of the spectral expansion suggests that if the theory is consistent, and the renormalization constant of the photon field small enough, then a very massive, unstable, gauge-invariant, neutral vector boson might exist. Its interaction can be strong as well as electromagnetic and an estimate of the effect of this heavy photon on high-energy electron-electron and electron-positron scattering is made. The experimental validity of quantum electrodynamics, for distances down to $r < 10^{-13}$ cm, implies that the heavy photon mass must be much larger than an electron mass. (auth)

9231 ON SOME MISCONCEPTIONS ABOUT RELATIVISTIC CO-ORDINATE TRANSFORMATIONS. J. E. Romain (General Dynamics, Fort Worth, Tex.). Nuovo Cimento (10), 30: 1254-71(Dec. 1, 1963).

Some authors have recently attempted to substitute alternate formalisms for the Lorentz transformation of special relativity. Their main purpose is to avoid conceptual difficulties that they feel are linked with the asymmetrical aging that leads to the so-called clock paradox. It is shown that the interpretation of their theories is fallacious and based on a misconception. The new schemes and the conventional special relativity are physically equivalent, and differ only by the choice of units. Therefore, the adoption of one or the other of these formalisms is completely irrelevant in so far as the description of the physical phenomena is concerned. These remarks may help one to dispose of some physically unwarranted philosophical misgivings regarding asymmetrical aging. Some constants in the transformation formulas of special relativity depend directly on the choice of the units to be used. However, several authors claim to derive the values of those constants from physical arguments without mentioning the units. It is shown that all such arguments involve some fallacy. (auth)

9232 ON THE VON NEUMANN ALGEBRAS GENERATED BY FIELD OPERATORS. M. Guenin and B. Misra (Univ. of Geneva). Nuovo Cimento (10), 30: 1272-90(Dec. 1, 1963).

It is shown that the von Neumann algebra R_Δ that is generated by field operators of an open space-time domain Δ is never a factor of type I_n (with $n < \infty$) or II_1. An argument is sketched to show that the factor R_Δ associated with a bounded and open space-time domain Δ is not of type I_∞ either. It is noticed that a variant of this argument may be utilized for showing that the factors associated with special space-time domains are not of type II_∞. The arguments for ruling out the possibility of types I_∞ and II_∞ are incomplete to the extent of two unproved mathematical propositions that however are likely to be true. Some of the known results pertaining to the structure of the algebra R_∞ that is generated by all field operators are also rederived from a slightly different point of view than the usual. (auth)

9233 THE ASSIGNMENT OF WAVE FUNCTIONS TO ENERGY DENSITIES AND PROBABILITY DENSITIES. J. S. Lomont (Polytechnic Inst. of Brooklyn) and H. E. Moses. Nuovo Cimento (10), 30: 1291-7(Dec. 1, 1963).

In many problems involving wave propagation, the squares of the absolute values of the wave functions rather than the wave functions themselves are the physically observable quantities. These quantities are interpreted as energy densities in the case of electromagnetic radiation, for example, and as probability densities in quantum mechanics. A theorem involving Fourier integrals that indicates a set of physical measurements of energy densities and probability densities in one-dimensional problems which lead to an essentially unique determination of the wave functions, is presented. For use in quantum mechanics, the measurements that are required can be expressed as the mean values of certain operators constructed from the position and momentum operators. (auth)

9234 ON THE CONNECTION BETWEEN RENORMALIZATION AND THE RENORMALIZATION GROUP IN QUANTUM ELECTRODYNAMICS. K. E. Eriksson Uppsala Univ.). Nuovo Cimento (10), 30: 1423-33(Dec. 16, 1963).

The connection between renormalization with a cut-off procedure and the renormalization group in quantum electrodynamics is discussed. A formalism is used in which mass renormalization is multiplicative in character like charge renormalization and electron field renormalization. The cut-off dependence of the charge and mass renormalization constants is discussed. (auth)

9235 ON THE TREATMENT OF SINGULAR BETHE-SALPETER EQUATIONS. A. Bastai (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin), L. Bertocchi, S. Fubini, G. Furlan, and M. Tonin. Nuovo Cimento (10), 30: 1512-31(Dec. 16, 1963).

The properties of the bound-state solutions of the Bethe-Salpeter equation in the ladder approximation are investigated in the case of potentials strongly singular at the origin. The analogy with potential scattering and the connection to field theory are discussed. A method is given that allows the reduction of the singular problem to a regular one, and explicit solutions for eigenvalue and eigenfunctions are presented in a particular case. (auth)

9236 ON THE SOLUTIONS OF THE BETHE-SALPETER EQUATION. A. Bastai (Università, Turin and Istituto Nazionale de Fisica Nucleare, Turin), L. Bertocchi, G. Furlan, and M. Tonin. Nuovo Cimento (10), 30: 1532-54(Dec. 16, 1963).

The solutions of the Bethe-Salpeter equation are studied for bound states, in the ladder approximation, in the case of potentials both regular and singular near the origin. Two methods are presented, one in momentum space, the other in co-ordinate space, which allow the complete determination of eigenvalues and eigenfunctions, in the case where

both the total energy of the state and the mass of the exchanged particle are zero. (auth)

9237 SOLVABLE POTENTIALS. A. K. Bose (Université, Montreal). Phys. Letters, 7: 245-6(Dec. 1, 1963).

A natural method of constructing solvable Schroedinger potentials is formulated and then applied to construct a class of solvable potentials. (R.E.U.)

9238 A NEW METHOD IN THE QUANTUM MECHANICAL TRANSPORT THEORY AND THE DISSIPATION-FLUCTUATION THEOREM FOR THERMAL DISTURBANCES. R. Enderlein (Universität, Berlin). Phys. Letters, 7: 326-9(Dec. 15, 1963).

The validity of the dissipation-fluctuation theorem for transport processes induced by thermal disturbances is examined. The theorem is found to hold rigorously in the limit of vanishing thermal disturbances. (L.B.S.)

9239 PRECESSION EQUATION OF A SPINNING PARTICLE IN NONUNIFORM FIELDS. U. Fano (National Bureau of Standards, Washington, D. C.). Phys. Rev., 133: B828-30(Feb. 10, 1964).

The general equation governing the changes of orientation of a spinning particle is expressed in a compact tensorial form that represents an extension of the vector equation of Larmor precession. The time derivative of each component of a mean multipole moment of the particle is a linear combination of the multipole moments of all orders, subject to selection rules that express the interesting features of the motion. (auth)

9240 SUMMATION OVER FEYNMAN HISTORIES: CHARGED PARTICLE IN A UNIFORM MAGNETIC FIELD. M. L. Glasser (Battelle Memorial Inst., Columbus, Ohio). Phys. Rev., 133: B831-4(Feb. 10, 1964).

Using a particular parameterization of paths, the nonrelativistic propagator for a charged particle in a uniform magnetic field is derived by the Feynman method of summation over histories. It is shown that this sum is independent of the parameterization as long as the classical path is included. The result is used to obtain the density matrix for the system. (auth)

9241 SIMPLIFIED APPROACH TO THE GROUND-STATE ENERGY OF AN IMPERFECT BOSE GAS. II. CHARGED BOSE GAS AT HIGH DENSITY. Elliott H. Lieb (International Business Machines Corp., Yorktown Heights, N. Y.) and Arthur Y. Sakakura. Phys. Rev., 133: A899-906(Feb. 17, 1964).

Foldy, and later Girardeau, calculated the ground-state energy of a charged Bose gas at high density. The common first term obtained by these authors is rederived by means of a nonperturbation method developed previously. It is proposed to establish the validity of this common result, which was not proved; to establish the validity and usefulness of the nonperturbation method. It is shown that the method will give the correct functional dependence of the ground-state energy on the density at low density, although the exact coefficient must await a numerical computation. (auth)

9242 ANALYSIS OF THE BOGOLIUBOV METHOD APPLIED TO A SIMPLE BOSON MODEL. W. H. Bassichis and L. L. Foldy (Case Inst. of Tech., Cleveland). Phys. Rev., 133: A935-43(Feb. 17, 1964).

A simple model of a boson system is considered for which the exact Schrödinger equation reduces to a difference equation that can be solved numerically. Application of the Bogoliubov method and comparison of its results with the numerical results then yield some insight into the validity of the Bogoliubov approximations. The simple model considered has, in the absence of interactions, only a zero energy state and two states of unit energy available to each boson. Initially there is assumed to be no interaction between bosons in the degenerate excited states and all existing interactions are assumed to be repulsive. The ground-state energy is calculated in the Bogoliubov approximation, with and without the depletion effect considered, and in another numerical approximation. These results and the results of the numerical solution of the exact Schrödinger equation converge to the Bogoliubov result with depletion ignored when the number of particles in the system approaches infinity. It is surprising to note that, for the interaction strengths considered, the Bogoliubov result is within 3% of the numerical result for as few as 32 particles in the system, and within 10% for only 4 particles. A modification of the above system is considered in which there exists an additional two-body interaction between particles in the degenerate excited states that may be attractive or repulsive. It is shown that the ground-state energy, with this additional interaction present, deviates from the Bogoliubov value linearly with the strength of the added interaction, i.e., $W = W_{Bog} + \alpha F$ (with F the strength parameter of the interaction). The factor α is found to be small and constant over a wide range of F and in this range the deviation of W from the Bogoliubov value is small. There is, however, a transition point F_T, beyond which α is constant and large and the usual Bogoliubov approximation is invalid for interactions more attractive than that characterized by F_T. A Bogoliubov-like approximation is shown to be quite accurate in this region. It is then shown that F_T^{-1} is a linear function of the number of particles in the system. (auth)

9243 MODIFIED KHURI SERIES AND ITS CONVERGENCE FOR A SINGLE YUKAWA POTENTIAL. Akbar Ahmadzadeh (Univ. of California, Berkeley). Phys. Rev., 133: B1074-8(Feb. 24, 1964). (UCRL-10929)

The Khuri series for the partial-wave amplitude was modified in such a way as to explicitly single out the Born term. In deriving this modified series it is shown that weaker asymptotic conditions are required on the partial-wave amplitude than those used by Khuri. The convergence of these series was investigated for the case of a single Yukawa potential. It is found that the modified series converges considerably faster than the Khuri series. (auth)

9244 THE UNCOUPLED PHASE METHOD FOR INTERACTIONS WITH HARD CORES. Pran Nath, G. L. Shaw, and C. K. Iddings (Stanford Univ., Calif.). Phys. Rev., 133: B1085-9(Feb. 24, 1964).

A system of n strongly coupled, two-body channels may be sufficient to describe a given set of reactions. A theoretical calculation on the other hand, might completely neglect one of these channels. The uncoupled phase method is a nonperturbative formalism (based on a potential model) relating the "uncoupled" scattering amplitudes describing the n−1 channels to the actual amplitudes for all n channels. It is shown that the uncoupled phase method remains a quantitative procedure over a wider range of conditions than originally anticipated. The method is derived for interactions with hard cores. By performing a two-channel computer experiment, the method is seen to be quantitatively accurate for Yukawa interactions with hard cores; this holds for p-wave as well as s-wave orbital angular momenta, and in the case that one of the channels is closed as well as when both are open. (auth)

9245 VARIATIONAL PROPERTY OF FREE-ENERGY PERTURBATION THEORY. Harold Falk (Army Electronics

Research and Development Labs., Fort Monmouth, N. J.). Phys. Rev. Letters, 12: 93-4(Jan. 27, 1964).

It is shown that a form of perturbation series for the free energy of a system of N particles has the property that at an arbitrary odd order the truncated series provides an upper bound for the exact free energy. The widely applied weak form of the Peierls variational theorem corresponds to a truncation of the perturbation series at first order. Boson and fermion many-body systems are considered. (C.E.S.)

9246 FOUNDATION OF SPONTANEOUS BREAKDOWN OF SYMMETRIES. Mahiko Suzuki (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 30: 627-35(Nov. 1963).

It is shown in a simple model that physical masses can split even without particle mixture in a hamiltonian in which bare masses are degenerate and permutation symmetry holds among bare particles. Infinity of the normalization volume is indispensable for proof. In this connection the problem of representation of an operator ring is discussed. A model of quantum number nonconservation is similarly considered. (auth)

9247 THE RELATION BETWEEN CLASSICAL MECHANICS AND WAVE MECHANICS. Yoshio Nishiyama (Tokyo Univ.). Progr. Theoret. Phys. (Kyoto), 30: 657-90(Nov. 1963).

Introducing a dimensional unit $\hbar$ into classical mechanics, classical wave functions $\sqrt{\rho_1}\exp(iS_1/\hbar) - \sqrt{\rho_2}\exp(iS_2/\hbar)$ for a one-particle system in the configuration space where $\sqrt{\rho_1}\exp(iS_1/\hbar)$ corresponds to the incident path (or one half) of an orbit and $\sqrt{\rho_2}\exp(iS_2/\hbar)$ to the outgoing (or another half) and ρ's and S's are densities and actions, respectively, are made. These classical wave functions are compared with the corresponding wave functions of solutions of the Schroedinger equation for three one-particle systems, the scattering by a Coulomb potential, the linear harmonic oscillator, and an electron bound by a Coulomb potential. From the essential correspondence between them it is concluded that the Schroedinger wave function describes the steady, causal, but a little imaginary, motion of the one-particle system as $\sqrt{\rho}\exp(iS/\hbar)$ in the configuration space where ρ is a density and S an action, and that the states that the wave equation describes exist continuously (not discrete) and the (discrete) stationary states are the ones where $\sqrt{\rho}\exp(iS/\hbar)$ is uniquely determined throughout an orbit. The Dirac equation shows that an electron has four characteristics besides its momentum at a position. The scalar wave equation of optics (or the electromagnetic wave equation) can be considered as the Schroedinger equation for the motion of a photon in a potential. A quantum-electrodynamical wave equation, which is composed of the Dirac equation with a Coulomb potential and the electromagnetic wave equation, is constructed for the steady motion of a one-electron system without recourse to the so-called second-quantization method. It gives finite energy shifts. A line shift is calculated. (auth)

9248 INVESTIGATION OF KINETIC EQUATIONS FOR COLLISIONLESS CHARGED PARTICLES. A. N. Dyukalov. Zh. Prikl. Mekhan. i Tekhn. Fiz., No. 2, 80-5 (Mar.-Apr. 1963). (In Russian)

Kinetic equations were developed for a system of stationary charged particles. An analysis was made of particle flux over a discontinuity, and boundary conditions were developed for finite particle distribution. (R.V.J.)

9249 PRIMENENIE METHODOV KVANTOVOI TEORII POLYA K ZADACHAM MNOGIKH TEL. (Application of Quantum Field Theory to Problems of Compounds). A. I. Alekseev. Moscow, Gosatomizdat, 1963. 134p.

Seven articles are included on quantum field theory applications to the problems of compounds. Separate abstracts have been prepared for each. (R.V.J.)

For abstracts of individual papers see: 9210, 9250, 9251, 9252, 9253, 9542, and 9543.

9250 ONE-DIMENSIONAL SPECTRUM FOR NONIDEAL FERMI GAS. V. M. Galitskii. p.3-64 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

The energy and attenuation of quasiparticles were determined by Green's one-dimensional propagation function. Energy spectra and ground states for nonideal Fermi gases with positive particle interaction potential were found. (tr-auth)

9251 EFFECTS OF "PAIRING" IN A P-STATE FERMI SYSTEM. Yu. A. Vdovin. p.94-109 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

Interactions of p-state Fermi particles were studied. One-dimensional spectra and collective excitations were analyzed. It is shown that the size of a slit in the one-dimensional excitation spectra is not a function of the total pair moments forming a condensate. Collective excitation spectra were studied with the assumption of pairing in the $^3P_0$ state. A dispersion law was found for excitation moments j = 0, 1, and 2. Charged particle excitation with j = 0 transforms into high-frequency plasma oscillations. (tr-auth)

9252 MAGNETIC PROPERTIES OF RELATIVISTIC GAS AT ZERO TEMPERATURE. Yu. A. Kartsev. p.110-13 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

The behavior of a relativistic ideal electron gas at zero temperature in a uniform magnetic field was studied using Green's functions. Corrections were made for chemical potential and ground state energy, and an expression was developed for diamagnetic and paramagnetic susceptibility. (tr-auth)

9253 APPLICATION OF QUANTUM FIELD THEORY TO CHARGED PARTICLE COULOMB SCATTERING IN A SUBSTANCE. M. I. Ryazanov. p.114-29 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

A method similar to the diagram method in quantum field theory was used for estimating multiple scattering. The case of charged particles with upper momentum limited by atom mass and lower momentum limited by the condition $p \gg \lambda$ was analyzed. (R.V.J.)

9254 AN ANALYSIS OF THE GHOST PROBLEM IN RELATIVISTIC FIELD THEORIES. David Korff. Thesis, Waltham, Mass., Brandeis Univ., 1963. 100p.

The ghost state problem is discussed both from the viewpoint of the Lee model and relativistic field theory. It is found that fundamental differences occur between the two cases. The so-called "ghost states" of relativistic field theory occur with imaginary mass, which is shown to correspond to hyperlight-velocity particles. These particles are investigated both classically and from the viewpoint of the group theory of Lorentz transformations. It is found that within the context of the formalism of quantum field theory, a consistent correlation of ghost states with the ghost poles of a relativistic propagation is impossible. Finally those specific features of the Lee model which allow for a consistent interpretation of the ghost problem are discussed. It is seen that these features do not occur in realistic field theories. (Dissertation Abstr.)

Geophysics

9255 (AWRE-O-68/63) MAGNETIC AND ELECTRIC FLUCTUATIONS IN THE FREQUENCY BAND 0.1–10.0 c/s ARISING FROM THE STARFISH HIGH ALTITUDE NUCLEAR EXPLOSION OF 9th JULY 1962. J. A. Russell, B. L. Elphick, M. W. Alcock, E. E. Cogger, and J. M. Ley (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Nov. 1963. 39p.

Fluctuations in the earth's electric and magnetic fields during the explosion were monitored by telluric measurement stations at Christmas Island and Salisbury Plain. The recorded signals are presented and discussed, and the monitoring equipment is described. (D.C.W.)

9256 (AWRE-O-69/63) ELECTRIC AND MAGNETIC FLUCTUATIONS IN THE FREQUENCY BAND 0.1–10.0 c/s ARISING FROM AMERICAN AND RUSSIAN HIGH-ALTITUDE NUCLEAR EXPLOSIONS. J. A. Russell, B. L. Elphick, E. E. Cogger, M. W. Alcock, and J. M. Ley (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Nov. 1963. 27p.

Explosions were monitored in 1962 by telluric measurement stations on Christmas Island and Salisbury Plain. The equipment is described, and the signals from five explosions are presented and discussed. (D.C.W.)

9257 (NP-13527) STUDIES OF THE F-REGION BY THE INCOHERENT BACKSCATTER METHOD. Technical Report No. 274. J. V. Evans (Massachusetts Inst. of Tech., Cambridge. Lincoln Lab.). July 24, 1962. 62p.

The distribution of electrons in the F-region of the ionosphere was measured by observing the weak incoherent backscatter signal. These measurements were first made early in 1960 and were continued throughout 1961. All the electron density profiles measured up to the end of 1961 are given, together with results of spectral analyses of the signals made early in 1962. The distribution of electrons above the peak of the F-region has been a subject of special study. On the basis of the results obtained, the scale height of the electron density increases with height; that the ion temperature is not very dependent on height, though it does show a marked diurnal variation; that the electron-to-ion temperature ratio is 1:1 during the hours of darkness, but during the daytime increases to a peak value ~1.6:1 around noon; and that the scattering cross section for the electrons is close to the expected value when allowance is made for the electron-ion temperature ratio. 60 references. (auth)

9258 (RM-3525-PR) CLOSE-IN ELECTROMAGNETIC FIELDS PRODUCED BY NUCLEAR EXPLOSIONS. W. Sollfrey (RAND Corp., Santa Monica, Calif.). Apr. 1963. 35p. (AD-404917)

The close-in electromagnetic fields produced by deflection in the earth's field of Compton electrons from a nuclear explosion are analyzed. Maxwell's equations in spherical coordinates are solved by an expansion in the perturbation fields, taking into account the space and time dependence of the conductivity and Compton current. The field structure is determined, and it is shown that the peak change in field is only 10%. (auth)

9259 LATITUDE AND HEIGHT DEPENDENCE OF ATMOSPHERIC DISTURBANCES CAUSED BY TYPE M SOLAR CORPUSCULAR STREAMS. B. D. Fomenko, I. V. Bonelis, and V. V. Kubyshkin (Volgograd Teachers' Inst., USSR). Soviet Astron.-AJ (English Transl.), 7: 534-5 (Jan.-Feb. 1964).

The latitude dependence of atmospheric disturbances was detected from a data study. It is found that the amplitude of atmospheric disturbances increases with geomagnetic latitude. The data of radio soundings show that the disturbance occurs in the atmosphere. (auth)

Low Temperature Physics

9260 (CONF-301-24) SPATIAL DEPENDENCE OF PAIR CORRELATION FUNCTIONS IN NONHOMOGENEOUS SUPERCONDUCTORS. William Silvert (Brown Univ., Providence). [1962]. Contract [AT(30-1)-1772]. 10p.

From International Conference on the Science of Superconductivity, Hamilton, N. Y., Aug. 1963.

An expansion in powers of the energy gap of the position-dependent pair correlation function and Green's function of superconducting states is obtained for an arbitrary variation of the electron-electron interaction. The energy gap equation takes the form of a functional relation between the energy gap and the normal Green's functions formed from solutions of the one-particle Hamiltonian. A graphical method is used to analyze problems of complicated geometry, and the falloff of the correlation function in a normal metal is calculated in regions of finite and semi-infinite superconductors. (auth)

9261 (LNF-63/71) NONVANISHING PARAMAGNETIC SUSCEPTIBILITY IN SUPERCONDUCTORS AT ABSOLUTE ZERO. Note No. 219. H. H. Nickle (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratori Nazionali, Frascati). Nov. 15, 1963. 5p.

An explanation is proposed for the observation of Knight shifts at 0°K in nuclear magnetic experiments on Hg, Sn, and V, in contradiction to the predictions of the Barden-Cooper-Schrieffer theory of superconductivity. (D.C.W.)

9262 (NP-13492) A RESEARCH INVESTIGATION OF THE FACTORS THAT AFFECT THE SUPERCONDUCTING PROPERTIES OF MATERIALS. Progress Report No. 1, June 15–December 15, 1963. R. W. Schmitt, H. R. Hart, Jr., P. S. Swartz, R. L. Fleischer, C. P. Bean, J. D. Livingston, R. W. DeBlois, W. DeSorbo, T. A. Buchhold, and P. J. Molenda (General Electric Co. Research Lab., Schenectady, N. Y.). Dec. 1963. Contract AF33 (657)-11722. 63p. (BPSN-63-6899-737102)

The phenomenology of the relation between the critical current density and a-c losses of high-field superconductors was examined experimentally and theoretically. The fundamental processes that underlie the phenomenological relationships are the interactions between the electromagnetic structure of type II superconductors and their metallurgical structure. Theoretical and experimental studies of these interactions, especially the effect of surfaces and of radiation-induced defects, are described. Preliminary studies were also made of losses in Nb as a function of temperature in which the mechanisms of loss may not be identical to those in high field superconductors. (auth)

9263 (JPRS-22588) ON THE SPECIAL FEATURES IN THE ELECTRON SPECTRUM OF SUPERCONDUCTING COMPOUNDS. I. B. Borovskii (Borovskiy). Translated from Tr. Inst. Met. im. A.A. Baikova, Akad. Nauk SSSR, No. 15, 79-87(1963). 12p. (OTS-64-21197)

Relations between the superconducting state (particularly T_c) and the electronic structure of the atoms as well as the structure of the crystal lattice were noted and were verified by investigating the fine structure of x-ray spectra of pure metals and compounds. Apparently, when superconducting compounds are formed from nonsuperconducting

elements, the electronic energy spectra of the compounds acquire a similarity to that of the superconducting metal closest in the given row of the periodic system. (D.C.W.)

9264 CURRENT BEHAVIOUR IN A SUPERCONDUCTING SOLENOID PRIOR TO AND AT BREAKDOWN. M. W. Dowley (IBM Corp., San Jose, Calif.). Appl. Phys. Letters, 4: 41-3(Feb. 1, 1964).

The rate of change of current in a superconducting solenoid wound with Nb–Zr wire was measured by observing the voltage across the secondary of a transformer in series with the solenoid. Several similar, reproducible pulses were observed up to breakdown, and the signal at breakdown indicates the appearance of a small resistance due to a flux jump that grows with time and results in breakdown. The observations support the dissipative flux jump hypothesis of current degradation in superconducting solenoids. (D.C.W.)

9265 EFFECT OF NEUTRON IRRADIATION ON CRITICAL CURRENTS IN HARD SUPERCONDUCTORS (Nb_3Sn AND NbZr). J. P. McEvoy, Jr. (Radio Corp. of America, Camden, N. J.), R. F. Decell, and R. L. Novak. Appl. Phys. Letters, 4: 43-5(Feb. 1, 1964).

The critical current density of superconducting Nb_3Sn and Nb–Zr before and after fast neutron irradiation was determined from magnetization measurements at 4.2°K on tubular samples by an inductive technique. After irradiation, the critical current could not be induced in Nb_3Sn due to flux jump and the magnetic shielding and, consequently, the current density were well above the preirradiation values. No notable changes in the shielding properties and no flux jumps were observed in the Nb–Zr sample. The difference in radiation effects may be attributed to dislocations originally present in the Nb–Zr alloy. (D.C.W.)

9266 THE DESIGN AND PERFORMANCE OF A 10 KGAUSS SUPERCONDUCTING SOLENOID. D. Gugan (Briston Univ., Eng.). Cryogenics, 3: 220-4(Dec. 1963).

A 10-kgauss superconducting magnet (described) was wound with Nb–Zr wire, and its field and quenching properties were investigated. The measurements showed that frozen-in flux can cause variations of field calibration and uniformity. The variations were generally about 0.$\frac{1}{2}$% of the maximum field, but variations of 0.5% were sometimes observed. (D.C.W.)

9267 SUPERCONDUCTIVITY OF THE FIRST AND SECOND KIND IN TIN ALLOYS. S. L. Wipf (Imperial Coll. of Science and Tech., London). Cryogenics, 3: 225-31(Dec. 1963).

The change, on increasing addition of solute, from superconductivity of the first kind (positive surface energy) to superconductivity of the second kind (negative surface energy) was detected in tin alloys through the disappearance of a sharp Meissner effect and with it a differential paramagnetic effect. This was confirmed by static measurements that clearly showed the appearance of a lower critical field, below which (in the absence of trapped flux) a superconductor behaves like a body of zero permeability, and an upper critical field, above which it behaves like normal ($\mu = 1$); in between there is a mixed state which is not adequately described merely by the specification of the magnetization. The change observed was found to be in reasonable agreement, in its dependence on mean free path and temperature, with the theory of Ginzburg-Landau according to which it is dependent on the parameter K only. This means that the behavior observed for tin alloys should be observed in any superconductor of a similar K-value. (auth)

9268 SUPERCONDUCTING MAGNET DESIGN. J. D. A. Day (Mullard Research Labs., Redhill, Surrey, Eng.). J. Sci. Instr., 40: 583-5(Dec. 1963).

The reduction of the winding space in a superconducting magnet is an important design consideration. The problem of a design for a Helmholtz pair, based on the field at the center, the current density, and the coil separation, can be completely specified using this minimization criterion. The mathematical equations are solved numerically, and, after reduction to a nondimensional form, the results are presented. (auth)

9269 CRITICAL ALTERNATING CURRENT IN SUPERCONDUCTING FILMS. A. Mailfert, G. Fournet, and J. Huret (Laboratoire Central des Industries Electriques, Fontenay-aux-Roses, France). Phys. Letters, 7: 227-9(Dec. 1, 1963). (In French)

The critical currents in superconducting films of Nb–Zr are investigated from a current-field dependence for samples of Nb–25% Zr and Nb–15% Zr with different geometries. (R.E.U.)

9270 ON THE EXISTENCE OF CERTAIN ONE-ELECTRON STATES IN THE BCS ENERGY-GAP REGION. A. K. Gupta and G. S. Verma (Allahabad Univ., India). Phys. Letters, 7: 299(Dec. 15, 1963).

The frequency dependent Ohmic dissipation behavior of the attenuation of the magnetic field in a hollow superconducting cylinder is explained by the presence of certain one-electron states in the BCS energy-gap region. (L.B.S.)

9271 ONSET OF SUPERCONDUCTIVITY IN DECREASING FIELDS. D. Saint-James (CEN, Saclay, France) and P. G. Gennes. Phys. Letters, 7: 306-8(Dec. 15, 1963).

The Landau-Ginzburg wave function is used to show that in ideal samples the nucleation of superconducting regions in decreasing fields should always occur near the surface of the sample. In non-ideal samples the volume defects can also participate in the nucleation process. (L.B.S.)

9272 ELECTRON-PHONON INTERACTION, SUPERCONDUCTIVITY, AND THE THIRD LAW OF THERMODYNAMICS. H. Froehlich (Univ. of Liverpool). Phys. Letters, 7: 346-7(Dec. 15, 1963).

Observations on electron-phonon interactions lead to the assumption that a residual interaction exists in all metals, at low temperatures, it has an ordering effect on the electronic Fermi gas. This effect, which would require a modification of the third law of thermodynamics, would frequently lead to superconductivity. A weaker ordering effect should also result from attractive electronic interactions in ferromagnets at temperatures lower than the superconductive transition temperatures in metals with similar interaction parameters. (L.B.S.)

9273 PHONON CRITICAL POINTS REFLECTED IN SUPERCONDUCTING TUNNELING CHARACTERISTICS. D. J. Scalapino (Univ. of Pennsylvania, Philadelphia) and P. W. Anderson. Phys. Rev., 133: A921-32(Feb. 17, 1964).

Van Hove showed that there are mathematical singularities in the phonon distribution in frequency $g(\omega)$ associated with stationary points in $\omega(q)$ versus q; $dg/d\omega$ has at least two infinite discontinuities, and approaches $-\infty$ at the upper end of the spectrum. Additional weaker singularities were discussed by Phillips. The current-voltage characteristic of superconducting tunnel diodes exhibits structure related to the phonon spectrum; the nature of the mathematical singularities in the tunnel characteristic associated with the Van Hove and Phillips singularities is investigated by means of the Eliashberg gap equation. Discontinuities and logarithmic singularities are predicted for the metal superconductor junction at T = 0, and inverse square-root singu-

larities as well in two-superconductor junctions. Analysis of Rowell's experimental curves for Pb and Sn in conjunction with neutron data on phonons in Pb provides definite evidence for the existence of such singularities and thus detailed confirmation of the theory. (auth)

9274 SUPERCONDUCTIVITY OF SOLID SOLUTIONS OF Ti AND Zr WITH Co, Rh, AND Ir. Ch. J. Raub (Univ. of California, La Jolla) and G. W. Hull, Jr. Phys. Rev., 133: A932-4(Feb. 17, 1964).

A detailed investigation of superconductivity in α and β-Ti and Zr solid solutions with Co, Rh, and Ir showed that T_c rises with increasing valence electron concentration n. Small amounts of Co, Rh, and Ir dissolved in α-Ti, or α-Zr increase T_c by a factor of 2 to 4. In the b-c-c phase region of the β-Ti alloys T_c goes through a maximum of 4°K at 90 at.% Ti, which is explained by Matthias' rule. (auth)

9275 SIZE EFFECT OF NUCLEAR SPIN RELAXATION TIME IN SUPERCONDUCTING ALUMINUM. Yoshika Masuda and A. G. Redfield (Columbia Univ., New York). Phys. Rev., 133: A944-7(Feb. 17, 1964).

Particles of aluminum having diameters less than 2000 Å were produced by evaporation in an argon atmosphere. The nuclear spin relaxation time was measured for three such samples in the normal and superconducting states between 0.36 and 1.3°K, for applied fields up to 400 G. In the normal state, and near T_c, the relaxation time is nearly the same as for bulk aluminum. Well below T_c the zero-field relaxation time is shorter than that of bulk aluminum, being less than one-fifth the bulk value at 0.4°K for two of the samples studied. At low temperatures there is also a field dependence that is characteristic of the superconducting state; T_1 increases with increasing field. At all fields, and low temperatures, the slope of a plot of $\ln T_1$ versus T_c/T indicates a gap considerably smaller than the bulk value, but the limited temperature range covered makes such conclusions dubious. (auth)

9276 MICROWAVE SURFACE IMPEDANCE OF SUPERCONDUCTORS OF THE SECOND KIND: In–Bi ALLOYS. Manuel Cardona, Gaston Fischer, and Bruce Rosenblum (RCA Labs., Princeton, N. J.). Phys. Rev. Letters, 12: 101-3(Jan. 27, 1964).

The temperature and magnetic field dependence of the microwave surface impedance of superconducting In–Bi alloys is measured at 24 Bc. (C.E.S.)

9277 MAGNETIZATION AND A SUPERCONDUCTING SOLENOID. Paul R. Aron (Univ. of California, Berkeley). Rev. Sci. Instr., 35: 33-9(Jan. 1964). (UCRL-10854)

The relation of the magnetization of Nb–25% Zr superconducting alloy and the magnetic field of a solenoid constructed of this material is discussed. Measurements of the magnetic field as a function of current, induced magnetic moment, history-dependent remanent moment, and other related properties are described. An approximate method of computing the magnitudes of these effects is discussed and the results are shown to agree with measurements. The coil critical current I_c is related to the short sample I_c, and the discrepancy is discussed in terms of the magnetization of Nb–Zr. (auth)

9278 LIQUID NITROGEN CRYOSTAT TO FACILITATE ISOTHERMAL ANNEALING STUDIES ON METALS AFTER HEAVY-PARTICLE BOMBARDMENT. F. Dworschak, K. Herschbach, and F. E. L. Witt (Univ. of Illinois, Urbana). Rev. Sci. Instr., 35: 46-8(Jan. 1964). (TID-19280)

A cryostat is described that was developed for irradiating a number of small metal specimens with a high beam-current of heavy particles at liquid nitrogen temperature. The specimens, which are mounted on a block, are taken out of the cryostat after irradiation and subsequently annealed in a temperature bath. The progress of annealing is followed by measuring the change in electrical resistivity of the specimens in liquid helium. (auth)

9279 MAGNETIZATION OF SUPERCONDUCTING NIOBIUM–ZIRCONIUM ALLOYS. J. P. McEvoy, Jr. and R. F. Decell (RCA, Camden, N. J.). 6p. (CONF-342-7)

From Conference on Magnetism and Materials, Atlantic City, Nov. 1963.

The magnetization of hollow cylinders of niobium–25 at.% zirconium has been measured at 4.2°K. The experimental results can be described by a model in which the magnetization is derived from an induced supercurrent density given by $J_c = \alpha/B_0 + H$, where H is the transverse magnetic field. This relationship is verified for Nb–25% Zr with a microstructure varied by mechanical deformation. The values of α and B_0 for several samples cold worked from 25 to 65% were determined. Extrapolation of the functional dependence of these parameters to negligible cold work (annealed samples) and maximum cold work (heavily strained wire) are shown to be in agreement with previously reported results on cylinders and wires. The current density in the absence of the Lorentz force, (H = 0), is found to be somewhat independent of the cold working, implying that the constant $J(0) = \alpha/B_0$ may be related to bulk electronic parameters. (auth)

9280 SOME REMARKS ON SUPERCONDUCTIVITY OF THE SECOND KIND. C. J. Gorter. 9p. (CONF-301-25)

From International Conference on the Science of Superconductivity, Hamilton, N. Y., Aug. 1963.

Corrections are proposed for the original layer model of the mixed superconductive state that does not satisfactorily describe the disappearance of this state at the higher critical field. (C.E.S.)

9281 LOW TEMPERATURE PHYSICS. L. C. Jackson, ed. Methuen's Monographs on Physical Subjects. New York, John Wiley and Sons Inc., 1962. 163p.

The production and maintenance of temperatures as low as 10^{-6}°K are discussed. Particular attention is given to air, hydrogen, and helium, in their liquid forms. Various means for measuring low temperatures are discussed. These include gas and resistance thermometers, thermocouples, and vapor-pressure and magnetic thermometers. The properties and theories of liquid and solid He^3 and He^4 are discussed. The specific heats of solids and gases are discussed as an example of low-temperature calorimetry. The variation with temperature of electric conductivity in metals, alloys, and semiconductors are discussed, and also the theory of superconductors. The theories of Sommerfeld and Bloch are presented. Magnetism is discussed including ferromagnetism, diamagnetism, de Haas-van Alphen effect, paramagnetism, paramagnetic resonance and saturation, magnetic rotation of the plane of polarization, antiferromagnetism, and nuclear alignment. (R.E.U.)

9282 PROBLEMS OF LOW TEMPERATURE PHYSICS AND THERMODYNAMICS. VOLUME 3. Proceedings of the International Institute of Refrigeration, Commission I, London, 1961. A. Van Itterbeek, ed. A. Pergamon Press Book. New York, Macmillan Company, 1962. 196p.

Methods for large-scale production, transport, and storage of liquid gases and of attaining and measuring temperatures below 1°K were discussed and are presented in 20

papers. Eight papers were chosen for NSA; 4 were previously abstracted. (R.E.U.)

For abstracts of individual papers see: 8704, 9283, 9284, 9285, 9286, 9287, 9288, and 9289.

9283 PULSED NUCLEAR MAGNETIC RESONANCE THERMOMETER. R. E. Walstedt (Clarendon Lab., Oxford). p.109-13 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962.

The measurement of nuclear spin temperatures by a pulsed NMR technique is described. A temperature of about 10^{-6}°K was obtained. The NMR thermometry is discussed in terms of simplicity of calibration, sensitivity, thermal contact, and heat introduced through the measurement. Results are given for copper and Na^{23}. NMR thermometry may be applied to the study of electronic structure of transition metals at less than 1°K and calibration of susceptibility vs absolute temperature in paramagnetic salts. (R.E.U.)

9284 APPARATUS FOR THE MEASUREMENT OF SPECIFIC HEATS DOWN TO 0.3°K BY MEANS OF He^3. B. B. Goodman, A. Lacaze, and L. Weil (Institut Fourier, Grenoble). p.133-6 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962. (In French)

An apparatus is described operating over more than one year with 70 cc S.T.P. He^3 by means of a mechanical pump only. It is used for the measurement of specific heats down to 0.3°K. (auth)

9285 A STUDY OF A PROPOSED He^3 REFRIGERATING CYCLE. H. London (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and E. Mendoza. p.137-41 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962.

A refrigeration cycle is described that makes use of the large osmotic pressure of dilute solutions of He^3 and He^4 for obtaining temperatures below 0.2°K. (R.E.U.)

9286 COOLING BY ADIABATIC DEMAGNETIZATION OF METALLIC ALLOYS. R. D. Parks and W. A. Little (Stanford Univ., Calif.). p.147-51 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962.

The adiabatic demagnetization of Th–Er alloys was studied. An alloy was obtained with a low Curie point. The thermal conductivities were obtained. The use of Th–3.5% Er in a cyclic magnetic refrigerator is reported. The possibilities of obtaining a temperature of 0.01°K are discussed. (R.E.U.)

9287 THE ANOMALOUS LATTICE SPECIFIC HEAT OF SUPERCONDUCTING NIOBIUM AT LOW REDUCED TEMPERATURES. H. A. Boorse and H. Leupold (Columbia Univ., New York). p.153-8 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962.

Specimens of single and polycrystalline superconducting niobium were examined and their thermal properties compared. The heat capacity of a single crystal sample of electron beam-melted Nb was measured at 1.4 to 2.3°K. (R.E.U.)

9288 APPARATUS FOR MEASURING SPECIFIC HEATS DOWN TO 0.03°K. A. R. Miedema and T. Haseda (Komerlingh Onnes Lab., Leiden). p.159-65 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962.

The sample was thermally connected to a heat sink of very low temperature and its temperature is decreased continuously. The thermal resistance between the sample and heat sink is known, therefore, the specific heat of the sample can be derived from the rate of change of its temperature. The heat sink consists of a number of CrK-alum single crystals and samples were $CuK_2SO_4 \cdot 2H_2O$, $Cu(NH_3)_4SO_4 \cdot 2H_2O$, and $CuSeO_4 \cdot 5H_2O$. (R.E.U.)

9289 THE REQUIREMENTS OF CRYOSTATS DEPEND, TO A LARGE EXTENT, ON SPECIAL TEST CONDITIONS AND THIS HAS BEEN THE SUBJECT OF SOME STUDIES IN THIS DOMAIN IN DRESDEN (G.D.R.). L. Bewilogua and R. Knoener (Technische Hoshschule, Dresden). p.191-6 of "Problems of Low Temperature Physics and Thermodynamics. Vol. 3." New York, Macmillan Co., 1962.

An apparatus is described that is capable of cooling by the evaporation of liquid nitrogen and then the condensation of it. It is called a thermosiphon and can be applied to reactor experiments where large amounts of heat are necessarily removed. Desorption cryostats using hydrogen and neon adsorbed on silica gel with hydrogen as cooling gas at 4 atm are also discussed. (R.E.U.)

Neutron Physics

9290 (AEEW-R-223) STABLE—A DIGITAL COMPUTER PROGRAMME FOR SOLVING THE TIME-DEPENDENT THREE-DIMENSIONAL ONE-GROUP NEUTRON DIFFUSION EQUATION. H. E. Wrigley (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). June 1963. 34p.

The computer program STABLE for solving the finite difference analog of the time-dependent, three-dimensional, one-group neutron diffusion equation coupled to auxiliary equations representing temperature, poison and control rod distributions is a modification of STAB. The modifications are discussed, and methods of determining the optimum values of the convergence parameters are presented, together with a discussion of the incidence and effect of complex eigenvalues. The operating procedures for the 704, 709 and 7090 versions of the program are given. (auth)

9291 (GA-4132) GATHER-II—AN IBM-7090 FORTRAN-II PROGRAM FOR THE COMPUTATION OF THERMAL-NEUTRON SPECTRA AND ASSOCIATED MULTIGROUP CROSS SECTIONS. G. D. Joanou, C. V. Smith, and H. A. Vieweg (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). July 8, 1963. 80p.

The program GATHER-II provides for the calculation of regular and/or energy adjoint fluxes, using the B_1, B_0, P_1, or P_0 approximations to the static Boltzmann transport equation. The other features, options, and limitations of the program are described; and the theoretical basis and procedures are presented. Two auxiliary programs used to prepare and modify data tapes are described, and input specifications are given, together with sample input and output listings. (D.C.W.)

9292 (KAPL-M-DBM-3) METHODS OF FLUX ITERATION FOR SOLUTION OF NEUTRON DIFFUSION PROBLEMS IN r-θ GEOMETRY. D. B. MacMillan (Knolls Atomic Power Lab., Schenectady, N. Y.). Oct. 21, 1963. Contract W-31-109-eng-52. 22p.

In connection with a project request that r-θ capability be added to KARE, an investigation was made to determine what method should be used for flux iteration. Azimuthal SLOR (successive line overrelaxation, with the lines being

curves of constant radius) is compared with radial SLOR and ADI (alternating-direction-implicit) iteration methods. It is concluded that azimuthal SLOR should converge several times faster than the other two methods. Difference equation coefficients derived for neutron diffusion in r-θ geometry by a variational method are compared with the coefficients derived by the standard method and used in CURE. (auth)

9293 (KAPL-M-RPC-10) SWAKRAUM—A SPATIALLY DEPENDENT THERMAL SPECTRUM PROGRAM FOR THE PHILCO 2000. F. D. Federighi and T. J. Reno, Jr. (Knolls Atomic Power Lab., Schenectady, N. Y.). Sept. 1963. Contract W-31-109-eng-52. 32p.

SWAKRAUM, a general one-dimensional, thermal space-energy program that calculates the thermal spectrum, cross-sections averaged over the spectrum, and the thermal flux as a function of position is described. The calculation is based on either a P-1 or Double P-1 expansion of the Boltzmann Equation. The P_0 component of the energy exchange kernel may be any scattering kernel, but the P_1 component must contain no energy transfer (Radkowsky prescription). The program assumes that the spectrum everywhere can be represented as a linear combination of a few spectra (the trial spectra). The program has a built-in blackness routine, so that calculations may treat discrete poison plates and control rods by thin region theory. (auth)

9294 (ORNL-TM-765) SOLUTIONS TO THE AGE EQUATION IN FINITE SYSTEMS WITH AN APPLICATION TO PULSED SOURCE EXPERIMENTS. C. A. Preskitt (Oak Ridge National Lab., Tenn.). Dec. 13, 1963. Contract W-7405-eng-26. 8p.

A series expansion was used to solve the age equation for finite systems. The results are used to show that a degree of attenuation of higher modes occurs when a reactor is excited by a neutron source whose energy is above that of fission neutrons. A numerical example is given for the case of a graphite-moderated reactor excited by a 14-Mev source. (auth)

9295 (WAPD-TM-369) MULE—A FORTRAN PROGRAM FOR THE CALCULATION OF THREE TYPES OF OVERTONE MODES. R. L. Ewen (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1963. Contract AT-11-1-GEN-14. 63p.

The MULE program, which finds the overtone modes associated with three diffusion theory eigenvalue problems is described. Overtone modes are calculated by application of the Wielandt transformation, which by use of an eigenvalue estimate allows any simple root to be isolated such that it and the corresponding eigenvector may be determined by power method iteration of the transformed matrix. In addition to finding the eigenvalues and direct fluxes for a series of modes, the MULE program calculates adjoint fluxes, adjoint weighted integrals, and various reactivity or synthesis parameters. Both slab and cylindrical geometry are included; the slab cores need not be symmetrical, and any radial-azimuthal overtone combination may be determined for cylindrical cores that are uniform azimuthally. (auth)

9296 THE AGE OF Po–Be NEUTRONS IN WATER AND IN GRAPHITE. M. A. J. Rathur and P. J. Grant (Imperial Coll. of Science and Tech., London). Brit. J. Appl. Phys., 15: 93-6(Jan. 1964).

The spatial distribution of indium resonance neutrons is found by measurement of the change in counting rate produced when a neutron-sensitive scintillation counter is covered by an indium absorber. The method was applied to the measurement of the age to indium resonance of Po–Be neutrons in water and in graphite. (auth)

9297 AN APPROXIMATION TO THE DOPPLER BROADENING FUNCTION $J(\theta,\beta)$ FOR RESONANCE ABSORPTION CALCULATIONS. G. Doherty (Australian Atomic Energy Commission, Sutherland, New South Wales). J. Nucl. Energy, Pt. A & B, 17: 435(Dec. 1963). (AAEC/TM-196)

Coefficients of the expansion involving $\eta(\theta,\beta)$, which is defined by $J(\theta,\beta) = J(\infty,\beta)\eta(\theta,\beta)$, are given. (R.E.U.)

9298 IMPROVEMENTS IN THE MANGANESE BATH TECHNIQUE FOR THE CALIBRATION OF NEUTRON SOURCES. E. J. Axton, P. Cross, and J. C. Robertson (National Physical Lab., Teddington, Middx., Eng.). J. Nucl. Energy, Pt. A & B, 17: 440(Dec. 1963).

Improvements in the calibration technique reported are continuous sampling of the manganese activity during irradiation and replacement of the Geiger counters by two 2 × 2 sodium iodide crystals with associated photomultiplier tubes. (R.E.U.)

9299 DANCOFF CORRECTION TABLES IN REGULAR ROD LATTICES. H. Kiesewetter and H. Marbach (VEB Entwicklung und Projektierung Kerntechnischer Anlagen, Berlin). Kernenergie, 6: 608-16(Nov. 1963). (In German)

With the help of Dancoff corrections the collision probabilities in regular rod lattices for constant, isotropic source distributions could be calculated approximately. The Dancoff correction is especially necessary for the calculation of resonance integrals and also for transport theory calculations of ϵ (fast fission factor) and f (thermal effectiveness value) and for neutron spectra in regular rod lattices among others. The dependence of the Dancoff correction on the average optical thickness in the moderator was tabulated for volume ratios between 0.23 and 99. The results were tested with the help of Monte Carlo calculations and direct calculations of the Dancoff integrals. (tr-auth)

9300 STUDIES OF THE OPTICS OF NEUTRONS. III. PROBLEMS OF POLARIZATION OF SLOW NEUTRONS. Otto Halpern (Pacific Palisades, Calif.). Phys. Rev., 133: B581-2(Feb. 10, 1964).

Various loosely connected problems dealing with the polarization of neutrons are discussed. Questions of polarization technique, the influence of absorption on polarizing mirrors, the connection between polarization and coherence, and the possible influence of the domain structure on the relative magnitude of nuclear- and magnetic-scattering amplitudes are treated. (auth)

9301 MEASUREMENT OF THE THERMAL NEUTRON DIFFUSION PARAMETERS OF WATER BY THE PULSED NEUTRON METHOD. Manuel M. Bretscher (Valparaiso Univ., Ind.). Proc. Indiana Acad. Sci., 72: 249-55(1962).

Pulsed neutron techniques were used to measure diffusion parameters of thermal neutrons in water at 26°C. Preliminary results are 212 ± 11 μsec for the mean thermal lifetime, 36,985 ± 1630 $cm^2\ sec^{-1}$ for the average diffusion coefficient, and 5021 ± 2490 $cm^4\ sec^{-1}$ for the diffusion cooling coefficient. From these results the thermal absorption cross section of hydrogen and the thermal diffusion length in water are found to be 322 ± 17 mb and 2.82 ± 0.09 cm, respectively. Moderators with geometric bucklings ranging from 0.000 cm^{-2} to 0.600 cm^{-2} were used for the lifetime measurements. Harmonic effects limit the precision of the results. (auth)

9302 INELASTIC SCATTERING OF NEUTRONS IN FERROMAGNETICS WITH IMPERFECTIONS. Li-zhi Fang

and Shi-jie Gu. Wu Li Hsueh Pao, 19: 673-81(Oct. 1963). (In Chinese)

A theoretical investigation is made on the scattering of neutrons by spin waves in ferromagnetic materials with imperfections. The differential cross section of inelastic scattering is calculated for a simple case. It is found that experimentation on scattering of thermal neutrons offers a method for the observation of localized modes of the spin waves. It is shown that the wave functions of the scattered spin waves and those of the localized modes form a complete set of orthonormalized wave functions in the subspace in which the total deviation of spins is equal to unity. (auth)

9303 SPATIALLY DEPENDENT INTEGRAL NEUTRON TRANSPORT THEORY FOR HETEROGENEOUS MEDIA USING HOMOGENEOUS GREEN'S FUNCTIONS. John Phillips Church. Thesis, Gainesville, Fla., Univ. of Florida, 1963. 181p.

A variant method for solving the integral Boltzmann transport equation is presented, which deals exclusively with the prediction of the spatial and speed dependence of the stationary distribution of thermal neutrons in heterogeneous media. The basic method is valid for any speed range. By using step functions to represent the spatial dependence of the collision probabilities, one may rearrange the integro-differential transport equation in a special way, such that the left hand side of the resulting equation contains only the leakage term and the term describing the total collision probability for the homogeneous medium of one region of the original problem. The Green's function technique is then used to convert the integro-differential transport equation to an integral equation. Although the resulting integral equation may be applied to heterogeneous media, the Green's function depends only on the total collision probability of the homogeneous medium of one particular region of the real neutron density problem; thus the use of the term "homogeneous Green's function." Specific numerical calculations are presented for the one-speed slab unit cell. The results calculated by the homogeneous Green's function method (HGI) are compared with published results of P_n, S_n, and double-P_n calculations. It is concluded that for unit cells that are of the order of a mean free path or less in thickness, the zeroth order approximation for the HGI method yields results comparable to very high order P_n and S_n calculations. Once the Green's function has been computed, additional unit cell calculations may be generated quite cheaply, each problem requiring only a few seconds of computation time. (M.P.G.)

9304 IMPROVEMENTS IN OR RELATING TO NEUTRON GENERATORS. (to Philips Electrical Industries Ltd.). British Patent 942,667. Nov. 27, 1963. Priority date May 5, 1959, Netherlands.

Equal atomic amounts of deuterium and tritium ions are accelerated toward copper or silver that is coated with Ti or Zr. The thickness of the layer of Ti or Zr is approximately the range of the ions. The layer readily absorbs hydrogen and after saturation of the layer by 125-kev ions, neutrons are produced at 14 Mev. (R.E.U.)

Nuclear Properties and Reactions

Refer also to abstracts 8348 and 9169.

9305 (AD-290788) ON OBLATE NUCLEAR DEFORMATIONS. Technical Report No. 14. Krishna Kumar and Michel Baranger (Carnegie Inst. of Tech., Pittsburgh). Dec. 1963. Contract 760(15) NRO24-439. 10p.

Calculations of nuclear shapes for nuclei with $50 < Z < 82$, $50 < N < 82$ show that if the correct single-particle spherical levels were used the nuclei have negative quadrupole moments (oblate or disk-shaped nuclei). Previously known strongly deformed nuclei have prolate shapes. The origin of the negative moments is examined. The known quadrupole moments of nearby odd spherical nuclei are noted also to be negative. (D.C.W.)

9306 (AWRE-O-79/63) NEUTRON CROSS-SECTIONS OF U^{235} AND U^{238} IN THE ENERGY RANGE 1 kev–15 Mev. PART I. BEST CROSS-SECTIONS FOR U^{238} BASED ON MICROSCOPIC EXPERIMENTAL AND THEORETICAL DATA AVAILABLE AT DECEMBER 1961. K. Parker (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Jan. 1964. 127p.

Recommended values are given for neutron total and partial cross-sections of U^{238} in the energy range 1 kev–15 Mev. The available experimental data are supplemented by estimates based on nuclear theory. Details of energy and angular distributions are given so that the data are complete for the purposes of neutronics calculations. Experimental and theoretical data which have become available since the best values were determined are discussed as far as possible. 215 references. (auth)

9307 (CEA-2380) NEUTRON PENETRABILITIES USING AN OPTICAL MODEL POTENTIAL. G. S. Mani, M. A. Melkanoff, and I. Iori (France. Commissariat a l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). 1963. 218p.

Neutron penetrabilities and reaction cross sections obtained with an optical model potential are tabulated for nuclei up to mass 230. The approximate expressions for the potentials as a function of energy are included. (D.C.W.)

9308 (CONF-374-1) THE $Be^9(He^3,p)B^{11}$ REACTION. W. R. Coker, M. M. Duncan (Georgia. Univ., Athens); J. L. Duggan, V. H. Webb (Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.); and P. D. Miller (Oak Ridge National Lab., Tenn.). [196?]. Contract [W-7405-eng-26]. 15p.

From American Physical Society, Southeastern Section, Lexington, Ky., Nov. 1963.

The differential cross sections for proton groups from the second through the ninth excited states of B^{11} were measured for He^3 energies between 1 and 3 Mev. As the bombarding energy is increased the angular distributions, in general, show more forward peaking as has been observed by other workers at higher bombarding energies. For some of the groups a significant change in the shape of the angular distributions is seen within the measured energy interval. Excitation functions were measured at 25° and 90° for the observed groups. The yield curves are seen to rise rapidly and smoothly without pronounced resonance structure. The above measurements indicate that this reaction is complex in nature and therefore not easily described in terms of any single type of reaction mechanism. (auth)

9309 (EANDC-US-44(L)) STATUS OF MEASUREMENTS OF THE TOTAL CROSS SECTION OF Pa-233. W. H. Burgus and F. B. Simpson (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Oct. 1, 1963. Contract [AT(10-1)-205]. 3p.

A process was developed for producing 1-g samples of separated Pa^{233} for measurements in the thermal energy region. With unseparated Pa^{233} samples, additional resonances were observed at 7.2, 9.4, 12.3, 14.5, and 16.1 ev. The energies and relative sizes of the resonances ob-

served up to now are given, together with Breit-Wigner parameters for resonances below 5.0 ev. Transmission measurements on separated samples gave results in agreement with previous measurements on unseparated samples up to 50 ev. (D.C.W.)

9310 (IA-863) STUDIES OF HIGHLY EXCITED NUCLEAR BOUND LEVELS USING NEUTRON CAPTURE GAMMA-RAYS. B. Arad (Huebschmann), G. Ben-David (Davis), I. Pelah, and Y. Schlesinger (Israel. Atomic Energy Commission. Soreq Research Establishment, Rehovoth). Sept. 1963. 66p.

Nuclear resonant scattering from individual levels was observed using the discrete energy gamma rays produced by thermal neutron capture. This permits a study of the highly excited nuclear levels near the particle threshold region. It was found that only levels in nuclei in closed shell regions have ground state transition probabilities large enough to be detected by this method. An extension of the technique is suggested which permits the gamma energy seen by the nucleus to be varied by about ±8 ev, using a rotating target. (auth)

9311 (IS-558) RADIOCHEMICAL STUDIES OF SOME PILE-NEUTRON FISSION YIELDS OF THORIUM-232. James Matthew Crook and A. F. Voigt (Ames Lab., Ames, Iowa). Nov. 1962. Contract W-7405-eng-82. 92p.

The general features of the mass yield curve in the pile-neutron fission of thorium-232 have been determined earlier, particularly by Turkevich and Niday using radiochemical methods; their yield data were accurate to about ±20 percent. Work was done to determine more accurately the yields of some mass numbers in thorium fission by radiochemical methods. It was hoped that the accuracy would be sufficient to determine radiochemically any fine structure in the yield curve similar to the mass spectrometrically determined fine structure in the thermal-neutron fission of uranium-235. In order to obtain greater accuracy with radiochemical methods, a four-pi beta proportional counter was used rather than a Geiger-Müller counter. Small counting samples with high specific activities were used to minimize self-absorption corrections. Thin aluminum-coated plastic films were used as sample supports to minimize absorption in the sample holder. The thorium samples, in the form of metal foils, were irradiated in the fast-neutron facilities of the Argonne National Laboratory, Lemont, Illinois. The fast-neutron flux was of the order of 10^{13} neutrons per second per square centimeter. The relative mass yields of mass numbers 89, 91, 99, 141, 143, 144, and 147 were determined by separating and counting strontium-89, yttrium-91, molybdenum-99, cerium-141, praseodymium-143, cerium-144, and neodymium-147. The relative yields of mass numbers 90 and 140 were determined by separating strontium-90 and barium-140 and then milking and counting their daughters, yttrium-90 and lanthanum-140. Published fission product separation procedures were modified for use with one milligram of appropriate carriers. Additional steps were used to ensure removal of the large amount of protactinium-233 produced in the neutron irradiation of thorium-232. The recoveries of the strontium and barium carriers were found gravimetrically; the recoveries of the other carriers were found spectrophotometrically. The mass numbers and their yields relative to mass number 140 were found to be: 89, 1.04 ± 0.06; 90, 1.09 ± 0.06; 91, 0.64 ± 0.04; 99, 0.40 ± 0.03; 140, 1.00; 141, 0.95 ± 0.06; 143, 0.95 ± 0.06; 144, 1.04 ± 0.06; and 147, 0.39 ± 0.03. The 91 mass yield was unaccountably low, but the others, including the yields of mass numbers 143 and 147 fit on the smooth yield curve of Turkevich and Niday. These yields are believed accurate to about ±6 per cent. Within this accuracy, no fine structure was found in these mass regions. (auth)

9312 (JINR-E-1457) ON COUPLING CONSTANTS IN μ^--CAPTURE. V. S. Evseev (Joint Inst. for Nuclear Research, Dubna, U.S.S.R.). 1963. 6p.

A modified set of coupling constants for describing the main processes in μ^- capture is presented. Calculations of the main effects (probability, hfs, etc.) in μ^- capture using both the new and old constants are compared with experimental values. (D.C.W.)

9313 (LA-2811(Add.)) OTHER DETAILS OF POST-FISSION BETA DECAY. James J. Griffin (Los Alamos Scientific Lab., N. Mex.). Oct. 1, 1963. Contract W-7405-eng-36. 32p.

Further numerical results obtained in calculations reported in LA-2811 are summarized. These include the time dependence of average beta disintegration energies and the average number of beta decays for various nuclides, as well as plots of these quantities at certain specific times as a function of the single parameter $\bar{z}$, which characterizes the fissioning nuclide. (auth)

9314 (NBL-204(p.15-20)) A STUDY OF THE GAMMA RADIATION OF THE ACTINIUM-227 DECAY SERIES. L. C. Nelson, Jr. (New Brunswick Lab., AEC, N. J.).

A study was made of the gamma radiation of the actinium-227 decay series. The properties investigated are the relative intensities, absorption properties, and total energy dissipated by actinium and its daughter products. (auth)

9315 (NP-13483) PRODUCTION OF HEAVY SPALLATION HYPERFRAGMENTS FROM THE INTERACTIONS OF 800 Mev/c K^- MESONS WITH EMULSION NUCLEI. P. Renard, J. Sacton (Brussels. Universite); and J. Zakrezewski (Warsaw. Univ. Inst. of Experimental Physics). Nov. 1963. 38p.

Interactions that produced an observable heavy spallation hyperfragment were analyzed. The mean mass and charge numbers of the hyperfragments, as well as the mean momentum imparted to them, were estimated. It is concluded that the cascade process contributes slightly more to heavy hyperfragment production than does the evaporation process. Additionally, it is suggested that internal collisions of the slowed hyperon largely accounts for the momentum imparted to the nucleus during the cascade. (D.C.W.)

9316 (NP-13510) ANGULAR DISTRIBUTION OF PHOTOFISSION FRAGMENTS FROM THORIUM. M. V. Ballariny (Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro). 1963. 13p. (Notas de Física, Vol. X, No. 12 (p.205-16)).

The angular distribution of photofission products from Th^{232}, relative to the photon beam, was measured using 12.4-Mev betatron bremsstrahlung incident on ThO_2 films on nuclear emulsions. An anisotropic distribution of the form $W(\theta) = a + b \sin^2 \theta$, corresponding to an electric dipole photon absorption, was obtained. The ratio b/a of the anisotropic fission yield to the isotropic yield was found to be 0.73 ± 0.15. (auth)

9317 (PR-P-59(p.37-45)) NEUTRON PHYSICS BRANCH. G. A. Bartholomew (Atomic Energy of Canada Ltd. Chalk River Nuclear Labs., Chalk River, Ont.).

Several alloys and compounds were studied with the neutron diffraction spectrometer at hole E13 of the NRX reactor. Also, the normal vibrations in β-brass and the lattice dynamics of Mo and Ni were investigated with the

triple axis crystal spectrometer. The level spins and multipole mixtures for Cr^{54} were determined by angular correlation measurements on the reaction $Cr^{53}(n,\gamma)Cr^{54}$. Additionally, precision gamma diffraction measurements were considered. An analysis indicates that the diffraction spectrometer stability is five times greater than previously believed. Measurements on resonant gamma rays from natural Mg continued, and its average resonant absorption cross section was measured. (D.C.W.)

9318 (SLAC-21) PION PHOTOPRODUCTION IN HYDROGEN AND BERYLLIUM. Martial Thiebaux (Stanford Univ., Calif. Stanford Linear Accelerator Center). Oct. 1963. Contract AT(04-3)-400. 46p.

Some numerical evaluations of the Drell cross section for pion production are presented. The construction of a number of tables and graphs for determining pion photoproduction rates is described, and some corrections to these basic rates are discussed. (auth)

9319 (TID-19940(p.22-76)) EXPERIMENTAL PROGRAM. (Minnesota. Univ., Minneapolis. Linear Accelerator Lab.).

Experiments on polarized proton scattering, proton elastic scattering, and proton reactions are summarized, along with some analyses that were performed. A data analysis program was written, and irradiations were performed in connection with space research and F^{18} distribution in biological tissue. (D.C.W.)

9320 (UCRL-10993) STUDIES IN NUCLEAR SPECTROSCOPY BY TWO-NUCLEON TRANSFER REACTIONS (thesis). Richard H. Pehl (California. Univ., Berkeley. Lawrence Radiation Lab.). Aug. 28, 1963. Contract W-7405-eng-48. 161p.

Alpha particle energy spectra from (d,α) reactions on Li^6, Be^9, C^{12}, N^{14}, and O^{16} were obtained for 24-Mev deuterons. The development of a high-resolution semiconductor $E(-dE/dx)$ counter telescope permitted the observation of alpha particle groups arising from the formation of final states of higher excitation than previously studied by this reaction. Angular distributions corresponding to resolvable final states are presented. Marked variation in the relative cross sections of final states was observed in most of the alpha particle energy spectra. In an effort to explain the nature of this preferential population these final states are correlated, where possible, with their expected configurations. The removal of two nucleons from the target nucleus should favorably excite levels whose configuration is two holes relative to the target configuration. Experimentally, however, formation of levels that require additional nucleon excitation are not appreciably inhibited in some cases. Possibly more than one reaction mechanism should be considered. The present evidence predominantly favors a pickup mechanism over knockout, but the relatively large cross section to several levels can be explained more easily by invoking a knockout mechanism. The difficulties involved in using the (d,α) reaction to test the validity of the isotopic-spin selection rule are discussed. An extensive review of the $O^{16}(d,\alpha)N^{14*}$ (2.31-Mev) transition over a range of bombarding energies is presented. A fairly extensive distorted-wave Born approximation analysis of several of the (d,α) transitions gave good fits to the alpha particle angular distributions. 112 references. (auth)

9321 (UCRL-11080) ON THE QUASI-PARTICLE INTERACTIONS IN SPHERICAL NUCLEI (thesis). Mannque Rho (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 21, 1963. Contract W-7405-eng-48. 186p.

The residual terms that arise from the Bogoliubov-Valatin canonical transformation are studied in angular-momentum representation and applied to some low-energy properties of spherical nuclei. The treatment makes use of the conventional perturbation theory, and its objective is to clarify the roles that each of the interaction terms play and to understand the success of the simplified calculations, such as the studies by Kisslinger and Sorensen. First, the Bardeen-Cooper-Schrieffer (BCS) theory applied to finite nuclei is reexamined, with a constant-pairing-matrix element approximation (G). It is found for a particular system that within coupling strengths of physical significance, there is only one value of G at which the BCS approximation and an exact number-conserving method coincide, whereas at smaller and larger values of G the two methods deviate in opposite directions. By use of the BCS solutions as the zero-order approximation, the effects of the residual terms on both even-A and odd-A nuclei are analyzed. The results obtained by applying our treatments to single-closed-shell nuclei ($N = 82$ and $52 \leq Z \leq 64$) show that for even-A nuclei, the term H_{22} is sufficient, and it appears that for odd-A nuclei, a first-order treatment of H_{31}, together with a complete account of the H_{22} term, gives good results. 56 references. (auth)

9322 (UCRL-11082) ALPHA-DECAY STUDIES OF PROTACTINIUM ISOTOPES (thesis). Vishnu B. Subrahmanyam (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Dept. of Chemistry). Oct. 22, 1963. Contract W-7405-eng-48. 71p.

The alpha decay of Pa^{231}, Pa^{229}, Pa^{227}, and Ac^{223} was studied by an alpha-particle—gamma-ray coincidence technique. A 180° double-focusing spectrograph or gold-silicon solid-state detectors for alpha analysis and a sodium iodide (Tl-activated) scintillation crystals for gamma-ray detection were used. The ground states of Pa^{227} and Pa^{229} are shown to be populated by 5.46- and 5.73-Mev alpha particles, respectively. The rotational bands populated in the decay of Pa^{227} are interpreted as being based on octupole vibrational levels predicted by the Bohr-Mottelson strong-coupling model. Modified decay schemes are presented. It is suggested that in odd-proton nuclei, the permanent nuclear deformation starts closer to the closed shell than in the even-even nuclei. A new alpha group at 5.47 Mev is noted in the alpha decay of Ac^{223}. No rotational structure is observed in the levels populated. Evidence is presented for the presence of two additional levels populated in the alpha decay of Pa^{231}. 40 references. (auth)

9323 (UCRL-11038) NEUTRON SPECTRA FROM HEAVY-ION BOMBARDMENT OF GOLD (thesis). William G. Simon (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 21, 1963. Contract W-7405-eng-48. 79p.

Neutron yields from the bombardment of a Au target by 164- and 142-Mev O^{16} ions were measured at angular intervals of 15° from 0 to 165°. Neutrons with energy from 0 to 12 Mev were detected by means of nuclear emulsions with use of the internal-radiator method. The 0-deg-yield measurements were extended to a neutron energy of 25 Mev by using a polyethylene radiator together with nuclear emulsions for neutron detection. The yields at 164 and 142 Mev are subtracted in order to obtain differential cross sections averaged over this energy interval, which are then transformed to the center-of-mass system. It is known that this reaction leads to fission in most cases, so that the problem of neutron-fission competition arises. The anisotropy coefficient, a, defined by the expression $W(\theta) =$

$1 + a\cos^2\theta$, is about 1 for 2-Mev neutrons and decreases rapidly with neutron energy. The distribution of neutrons is essentially isotropic above 6 Mev. This behavior disagrees with calculations of the angular distribution of neutrons from fission fragments, which are based on measured fragment angular distributions. It is concluded that some neutrons are emitted from the system before fission occurs. Calculations of the ratio of the neutron to fission width agree with this conclusion. The use of the internal-radiator method of neutron detection requires that the escape probability for protons from the emulsion layer be evaluated. Measurements of the multiple scattering of stopping protons, which were used in evaluating this probability, are included. These measurements are in agreement with theory. (auth)

9324 (UNC-5067) NEUTRON CROSS SECTIONS OF NATURAL CHLORINE. M. H. Kalos and J. H. Ray (United Nuclear Corp. Development Div., White Plains, N. Y.). Sept. 30, 1963. Contract DA-18-108-CML-7156. 31p. (AD-41981)

Complete sets of cross sections for natural chlorine are tabulated for incident neutron energies from 0.02 ev to 18 Mev. Cross sections for gamma and neutron production in neutron inelastic scattering are included, and Legendre polynomial coefficients to describe the angular distribution of elastically scattered neutrons are given. (D.C.W.)

9325 (AEC-tr-6285) NUMBER OF NEUTRONS EMITTED BY FISSION FRAGMENTS OF U^{235}. V. F. Apalin, Yu. N. Gritsyuk, I. E. Kutikov, V. I. Lebedev, and L. A. Mikaelyan (Akademiya Nauk S.S.S.R. Ordena Lenina Institut Atomnoi Energii). Translated by Helen J. Chick and James Terrell (Los Alamos Scientific Lab., N. Mex.). 1963. 16p.

An ionization chamber and a neutron detector containing cadmium were used to measure the number of neutrons ν emitted by the fragments during fission of U^{235} by thermal neutrons. The data obtained verify the hypothesis of the universal dependence of ν on the mass of the fragment. Calculations show that in the region of symmetric fission the excitation energy of the fragments increases by about 20 Mev. (auth)

9326 EXPERIMENTAL STUDY OF DOUBLE GAMMA EMISSION IN MONOPOLE TRANSITIONS IN THE NUCLEI O^{16}, Ca^{40}, AND Zr^{90}. Gilbert Sutter (Centre de Recherches Nucléaires, Strasbourg). Ann. Phys. (Paris) (13), 8: 323-51(July-Aug. 1963). (In French)

A theoretical outline is presented of double photon emission in monopole transitions. An experimental study of this phenomenon is carried out on the E(0) transitions in O^{16} (6.05 Mev), Ca^{40} (3.35 Mev), and Zr^{90} (1.75 Mev). (T.F.H.)

9327 EMISSION OF INTERNAL CONVERSION PAIRS—ANGULAR CORRELATION IN THE NUCLEUS B^{11}. STUDY OF RADIATIVE CORRECTIONS IN THE NUCLEUS O^{16}. Fernand Scheibling (Centre de Recherches Nucléaires, Strasbourg). Ann. Phys. (Paris) (13), 8: 353-83(July-Aug. 1963). (In French)

Nuclear de-excitation by the emission of electron-positron pairs is studied. The angular correlations in the emission are measured for the 2.14-Mev transition in B^{11}, and allow a calculation to be made of the multipolarity of this transition. From this multipolarity, it is concluded that the parity of the first excited state of B^{11} is negative, and that the angular momentum of the 2.14-Mev level is $J = 1/2$. The angular correlations in the monopole 6.05-Mev transition in O^{16} are measured, and radiative corrections to these correlations are determined at small angles. (T.F.H.)

9328 ELECTROMAGNETIC TRANSITIONS IN THE NUCLEUS O^{16}. Pierre Mennrath (Centre de Recherches Nucléaires, Strasbourg). Ann. Phys. (Paris) (13), 8: 385-406(July-Aug. 1963). (In French)

Partial widths of nuclear levels in O^{16} are studied by measurements on transitions involving the levels at 6.06, 6.13, 6.92, 7.12, 8.88, and 10.36 Mev. The measured partial widths are compared with widths calculated on the basis of models and theories. (T.F.H.)

9329 DESCRIPTION OF HEAVY SPHERICAL NUCLEI IN AN INTERACTING-QUASI-PARTICLE MODEL. APPLICATION TO THE ISOTOPES OF TIN. Robert Arvieu (Faculté des Sciences, Orsay, France). Ann. Phys. (Paris) (13), 8: 407-39(July-Aug. 1963). (In French)

The nuclear shell model is studied. The formalisms and approximations that can be used to obtain individual and collective states for heavy spherical nuclei are reviewed. The Bogoliubov-Valatin transformation and its applications are studied. Collective models are examined from the standpoint of a diagonalization approach and the method of "quasi-bosons." These results are applied in detail to the Sn isotopes, assuming a finite-length interaction. (T.F.H.)

9330 MEASUREMENT OF THE CAPTURE CROSS SECTION OF 5- TO 200-kev NEUTRONS FOR URANIUM-238 AND THORIUM-232. V. A. Tolstikov, L. E. Sherman, and Yu. Ya. Stavinskiĭ. At. Energ. (USSR), 15: 414-15 (Nov. 1963). (In Russian)

There are only a few experimental data on the radiative capture cross sections of U^{238} and Th^{232} in the energy range below 200 kev; measurements were therefore carried out for determining the ratio of these cross sections to the cross section of the $B^{10}(n,\alpha)$ reaction. The Th^{232} and U^{238} specimens and the ionization chamber with the B^{10} layer were exposed to a fast neutron flux. The measurements were carried out with a Van-de-Graaff accelerator, using the Li(p,n) reaction as the neutron source. The chamber and the specimens were placed at an angle of 91° with respect to the direction of the accelerated proton beam. The energy scatter observed amounted to ±4 and ±6 kev for the Th and U specimens, respectively. The radiative cross section values of U^{238} agreed well with previously reported data. At 54 kev, the value obtained was about 20% lower than that reported by other authors; similar differences were noted also at 171 and 158 kev. The radiative capture cross section of Th^{232} decreased with decreasing neutron energy; in this case, the previously reported data was about 30% below the results obtained. (TTT)

9331 THE INELASTIC SCATTERING CROSS SECTION OF 0.4- TO 1.2-Mev NEUTRONS ON INTERMEDIATE AND LIGHT NUCLEI. N. P. Glazkov. At. Energ. (USSR), 15: 416-18(Nov. 1963). (In Russian)

The previously described inverse-geometry method (Atomnaya Energ. 14, 400 (1963)) involving a He^3 spectrophotometer, was used for measuring the inelastic scattering cross section of neutrons on intermediate and light nuclei. The recoil due to elastic and inelastic scattering causes a marked spread in the energy of the scattered neutrons, complicating analysis of the spectra. On the other hand, because of the location of the levels of the light and intermediate nuclei, only one or two levels are usually excited by the scattering of the 1-Mev neutrons, making it possible to determine the partial inelastic scattering cross sections; these values may be correlated to completely determined isotopes. The measurements were carried out at

neutron energies of 0.4, 0.6, 0.8, 1.0 and 1.2 Mev. The inelastic scattering effect was obtained by subtracting the neutron spectrum measured without the scatterer from that obtained with a scatterer. The values obtained agree well with previously reported data. The inelastic scattering cross section was calculated by the following simplified formula $\sigma_{n'} = (1/n\bar{l}) \cdot [\int(\Delta')/P]$ where n = density of nuclei in the specimen; $\int(\Delta')$ = partial effect, corresponding to the inelastic scattering of the neutrons, under consideration of the efficiency of the He^3 spectrometer; l = the mean free path of the incident neutrons; and P = standardized total incident neutron flux. (TTT)

9332 DEPENDENCE OF THE AVERAGE KINETIC ENERGY OF FISSION FRAGMENTS ON THE MASS OF THE FISSIONING NUCLEUS. V. N. Okolovich, V. I. Bol'shov, L. D. Gordeeva, and G. N. Smirenkin. At. Energ. (USSR), 15: 419-20(Nov. 1963). (In Russian)

A relationship was derived by J. Terrell (Phys. Rev. 113, 527 (1959)) between the average kinetic energy of the fission fragments, $\overline{E}_k$, the charge, Z, and the atomic weight, A, of the fissioning atom. Deviations from the relationship were experimentally investigated, comparing the $\overline{E}_k$ values of the fission fragments of U^{233}, U^{235}, and U^{238}. The isotopic mixtures used in the experiments included: natural U and natural U depleted in U^{235} by a factor of 250, to which a 1% addition of U^{233} was made. Thermal neutrons were used for fissioning the $U^{233} + U^{235}$ mixture, and 2-Mev fast neutrons were employed for U^{238}. The following values were obtained for the $\overline{E}_k$ ratios of U^{233}/U^{238} and U^{235}/U^{238}: 0.9909 ± 0.0014 and 0.9938 ± 0.0018, respectively. The data indicated that $\overline{E}_k$ increases uniformly with increasing A_f, confirming the previously noted contradiction between experiment and theory. This could be explained by the fact that the assumption concerning the similarity in the critical configuration at the instant of the fission is not valid. The existence of a "fine structure" in the relationship proposed by Terrell seems to be indicated. In order to show the dependence of $\overline{E}_k$ on Z and A by a smooth curve, the introduction of a parameter $Z^2\sqrt{A}$ is proposed. (TTT)

9333 SCATTERING OF PROTONS FROM Be^9, B^{11}, Al^{27}, AND P^{31} IN THE ENERGY RANGE OF 8-14 Mev. Jun Kokame (Kyoto Univ.) and Jiro Muto. Genshikaku Kenkyu, 8: 340-55(Aug. 1963). (In Japanese)

Angular distributions and their energy dependence of the elastically and inelastically scattered protons from Be^9, B^{11}, Al^{27}, and P^{31} in the energy range 8 ~ 14 Mev were studied. The incident proton beam was magnetically analyzed, and the energy spread of the beam was about 20 kev. The energy dependence of the angular distribution and of the total cross section of the reaction $Be^9(p,p')$ are small in the energy region from 6 to 15 Mev. Variation with energy in the excitation function of the reaction $Al^{27}(p,p')$ [E_p = 7.8 ~ 9.5 Mev, 100 kev-step] is relatively small in comparison with the other (p,p') reactions on even-even nuclei. The angular distributions, their energy dependence, and total cross sections of p_1' and p_2' from P^{31} are roughly similar, in the energy range of 8 ~ 12.5 Mev. As the momentum transfer in both transitions is 2, these facts may favor an emphasis of the existence of the direct reaction process. The yield ratio between different energy levels of a residual nuclei is fairly constant with the incident beam energy in the case of Al^{27} and P^{31}. (auth)

9334 FRAGMENT KINETIC ENERGY AND MASS DISTRIBUTION FOR FISSION OF URANIUM BOMBARDED BY 55.3 Mev PROTONS. Shoji Shirato and Masao Seki. Genshikaku Kenkyu, 8: 356-400(Aug. 1963). (In Japanese)

Kinetic energy and mass distributions of fragments in the 55.3-Mev proton-induced fission of U^{235} and U^{238} were measured using a back-to-back arrangement of surface barrier type semiconductor detectors and a pulse division circuit. The detection system was tested by measuring fragment distributions for the thermal-neutron-induced fission of U^{235}. The pulse height defect of the detectors used was determined by comparing the single fragment energy distribution with the time-of-flight data of Milton and Fraser. When corrected approximately for the defect, the measured mass distribution for the thermal-neutron fission of U^{235} agreed well with the radiochemical data. In the case of 55.3-Mev proton-induced fission, corrections must be made for the projectile momentum and the neutron emission. A correction method for the neutron emission is discussed. A fair agreement is found between the corrected mass distribution for the 55.3-Mev proton fission of U^{238} and the radiochemical data of Stevenson et al. at the proton energies of 32 and 70 Mev. The most probable values of total fragment kinetic energy in the 55.3-Mev proton fissions of U^{235} and U^{238} were 150 ± 5.4 Mev and 152 ± 5.4 Mev, respectively. Their full widths at half maximum were both comparable with the one for the thermal-neutron fission. A small but definite difference was observed between the mass distributions obtained at 90° for U^{235} and U^{238} fissions; the peak-to-valley ratio in U^{238} was slightly larger than that of U^{235}. The mass distributions for 55.3-Mev proton fission of U^{238} measured at 90° and 143° in the laboratory system showed that the anisotropy of symmetric fission fragments was somewhat larger than that of asymmetric fission. This fact is not inconsistent with the Meadow's result which was interpreted by Malpern as caused by slow cascade nucleons. (auth)

9335 COULOMB EXCITATION LEVELS FOR ODD NUCLEI WITH 135 < A < 173. D. G. Alkhazov, K. I. Erokhina, and I. Kh. Lemberg. Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1363-76(Nov. 1963). (In Russian)

The B(E2)↑ levels of Ba^{135}, Ba^{137}, La^{139}, Pr^{141}, Nd^{143}, Nd^{145}, Sm^{147}, Sm^{149}, Gd^{157}, Dy^{161}, and Yb^{173} were studied by γN coincidence using pentacharged N^{14} ions accelerated to 52 Mev. The γ quanta were recorded by an ordinary spectrometer with a 40 × 40 mm NaI(Tl) crystal placed 4 mm from the target. Scattered nitrogen ions were recorded by four silicon p-n detectors 6-mm in diameter distributed 15 mm from the target at 135° to the ion beam. Six new levels were examined: 1.13 Mev (Ba^{135}), 0.80 and 0.57 Mev, (La^{139}), 0.85 Mev (Nd^{143}), 0.63 or 0.68 Mev (Sm^{149}), and 0.72 Mev (Gd^{157}). The parity and spin intervals were determined for all levels, and the half lives for the Ba^{135} 0.862-Mev level and Nd^{143} 0.74-Mev level were found to be 1.6×10^{-12} and 5.7×10^{-13} sec, respectively. The magnitude δ^2 was determined for the La^{139} transition at 0.166 Mev. Magnitudes F, estimated for all examined levels, were from 0.2 to 9.1; for La^{139} at 0.166 Mev, F ≤ 0.008. (R.V.J.)

9336 GAMMA AND ELECTRON INTERNAL CONVERSION SPECTRA IN THERMAL NEUTRON CAPTURE BY MERCURY NUCLEI. L. V. Groshev, A. M. Demidov, V. A. Ivanov, V. N. Lutsenko, and V. I. Plekhanov (Kurchatov Inst. of Nuclear Physics, USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1377-91(Nov. 1963). (In Russian)

Gamma spectra and internal conversion electrons emitted in (nγ) reactions on even-even Hg nuclei were studied. A Compton magnetic spectrometer with 0.3% resolving power for E_γ = 2 Mev and 0.6% for E_γ = 1 Mev was used for measuring the γ spectra. The thermal neutron capture cross section for natural mercury was 380 ± 20 b. Energies and conversion electron intensities for Hg even-even isotopes

were tabulated, and γ transition schemes were constructed. (R.V.J.)

9337 CONVERSION ELECTRON SPECTRA OF Gd FRACTION. A. S. Danagulyan, N. A. Lebedev, and A. T. Strigachev (Moscow State Univ. and Joint Inst. for Nuclear Research, Dubna, USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1392-3 (Nov. 1963). (In Russian)

A photorecording, constant field (ρ_{max} = 22.5 cm) spectrometer was used for measuring conversion electron spectra in neutron-deficient Gd isotopes. The obtained data on Gd^{147} ($T_{½} \approx 35$ hours) are tabulated. The results obtained for Gd isotopes with $T_{½} > 9$ days in agreement with published data. Relative electron conversion intensities related to Gd^{147} decay were determined. Eight new γ transitions were found and identified. The results indicate that Gd^{147} decay is more complicated than present data indicate. (R.V.J.)

9338 SPECTRA OF CONVERSION ELECTRONS EMITTED IN Re^{184} DECAY. B. S. Dzhelepov, G. S. Katykhin, V. K. Maidanyuk, and A. I. Feoktistov. Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1394-1401(Nov. 1963). (In Russian)

A β spectrometer was used for studying the conversion electron spectra of Re^{184}. Conversion lines exhibited either complex decay curves with $T_{½} \approx 38$ and 160 days or simple curves with $T_{½} \approx 160$ days. Decay curves for Re^{184} were compared with conversion lines for Re^{183} ($T_{½} \approx 71$ days). The curves for $T_{½} \approx 38$ days differ in their dip due to the isomeric state effect. Energy levels at 746, 1152, 1376, 1534, and 1470 kev and the transition at 84 kev were analyzed. (R.V.J.)

9339 ON THE DECAY OF Nd^{141}. E. I. Biryukov and N. S. Shimanskaya. Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1402-7(Nov. 1963). (In Russian)

A scintillation spectrometer with a multichannel analyzer was used in an investigation of Kx, β^+, and γ emissions and in measuring intensities of various components. The half life for Nd^{141} was found to be 157 ± 10 min, which differs from published data. Measurements on γ transitions revealed a new 1145-kev level; analysis of the γ spectra revealed neither the 420, 880, or 270 kev γ rays. The coincidence spectra indicate that the 150-kev gamma coincides with the 1145-kev, but not with the 1310-kev, and the 1145- and 1310-kev gammas do not coincide with the Kx emission. Data on relative intensities for Kx, β^+, and γ were used for developing the decay scheme for Nd^{141} with 92.2% capture to the Pr^{141} ground level. The shell model predicted $3/2^+$ for the Nd^{141} ground state, and this was confirmed by the K/β^+ and log ft (5.2) ratio for transitions to Pr^{141} ground state. (R.V.J.)

9340 DECAY OF Pr^{139}. E. I. Biryukov, V. T. Novikova, and N. S. Shimanskaya. Izv. Akad. Nauk SSR, Ser. Fiz., 27: 1408-11(Nov. 1963). (In Russian)

Data on Kx, β^+, and γ relative intensities and coincidence spectra were used for developing Pr^{139} decay (T = 4.92 hrs) with electron-capture at the 1610- and 1350-kev levels equal to 0.6 and 0.3%, respectively, and 99.1% for transition between Pr^{139} and Ce^{139} ground states (88.2% electron capture and 10.9% positron decay). The magnitudes of log ft were 6.7, 7.1, and 5.7, respectively. (R.V.J.)

9341 ENERGY LEVELS FOR Li^7 PHOTOSPALLATION. L. A. Kul'chitskii, Yu. M. Volkov, V. P. Denisov, and V. I. Ogurtsov. Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1412-18(Nov. 1963). (In Russian)

Angular and energy distributions of protons and tritons in Li^7 spallation by bremsstrahlung with E_{max} = 30 Mev were studied. Proton spectra at $E_{\gamma\ max}$ = 25 and 20 Mev were also studied, and the yield curve for $Li^7(\gamma,p)$ was found from the residual He^6 β activity. An analysis of γ dipole absorption of revealed Li^7 excited levels with spin and parity of $5/2^+$ and $3/2^+$. (R.V.J.)

9342 INVESTIGATION OF $Mg^{26}(p,\gamma)Al^{27}$ REACTION AT PROTON ENERGIES OF 1.8 TO 2 Mev. A. K. Val'ter, E. G. Kopanets, A. N. L'vov, A. Stegner, and S. P. Tsytko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1419-26 (Nov. 1963). (In Russian)

Seven resonances were revealed in an analysis of $Mg^{26}(p,\gamma)Al^{27}$ reactions at proton energies of 1.78 and 2.0 Mev. Gamma spectra and angular distribution asymmetry were investigated for the more intense resonances. The data were used for determining the spins and developing decay schemes for Al^{27} resonance levels at 9.995, 10.029, 10.087, 10.104, and 10.160-Mev. (R.V.J.)

9343 EXCITATION OF VIBRATIONAL LEVELS IN β DECAY OF NON-SPHERICAL NUCLEI. Yu. N. Devyatko, V. V. Lomonosov, and M. G. Urin. Izv. Akad. Nauk SSR, Ser. Fiz., 27: 1427-9(Nov. 1963). (In Russian)

Beta decay probabilities in odd-odd deformed nuclei with excited vibrational levels in corresponding even-even nuclei were calculated considering nucleon pair correlations. The ground states of odd-odd nuclei in the independent quasiparticle model were determined as ground states of corresponding even-even nuclei, plus two quasiparticles (neutron and proton). A microscopic concept was used for describing vibration levels in which collective excitations were interpreted as quasiparticle bound states. Studies were limited to permissible β transitions related to γ vibrational level excitations. (R.V.J.)

9344 SCATTERING OF ELECTRONS BY NON-SPHERICAL NUCLEI CONSIDERING MIXED STATES. B. I. Tishchenko (Inst. of Physics and Tech., Academy of Sciences, Ukrainian SSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1430-5(Nov. 1963). (In Russian)

Studies of electron scattering on non-spherical nuclei with each rotational band characterized by some definite K magnitude (projection moment on the nuclear symmetry axis) showed that under a certain assumption excitation extends only to the basic rotational band, responding to the same K magnitude as the ground state. A similar situation is encountered with electromagnetic probabilities of B(E2) transitions within the limits of the simple rotational model. However, the K magnitude is not a reliable quantum number and depends on an adiabatic approximation of rotation. An analysis was made of the effects of mixed states on electron scattering by nonspherical nuclei, considering only the case of non-oriented nuclei; F^{19}, Na^{23}, Mg^{25}, etc. (R.V.J.)

9345 LEVEL SPLITTING IN EVEN-MASS DEFORMED NUCLEI. N. I. Pyatov (Joint Inst. for Nuclear Research, Dubna, USSR). Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1436-41(Nov. 1963). (In Russian)

Spin states in odd-odd deformed nuclei are determined by unpaired neutron and proton moments (Ω). Moreover, two different projections $K = \Omega + \Omega_2$ are possible on the nuclear symmetry axis. In even-even deformed nuclei, as in odd-odd, two quasiparticle levels formed by two unpaired nucleons are in doublet states. The doublet state degenerates in the generalized and superfluid models. It was recently found that in odd-odd nuclei the state with parallel neutron and proton spins, and in even-even nuclei with antiparallel unevaporated nucleon spins, are as a rule the low energy

states. Level splitting and shift levels in rotational bands with K = 0 were calculated for Al^{26}, Al^{28}, P^{32}, Ho^{166}, Lu^{174}, Lu^{176}, and Er^{166}. Results were tabulated showing level configurations, ground and excited level spins, level splitting, and level shift energies. All calculations were made using a deformation parameter $\eta = 6$. Small deformation variations did not effect splitting energy magnitudes. (R.V.J.)

9346 GENEALOGICAL COEFFICIENTS OF A TRANSLATION-INVARIANT SHELL MODEL. Yu. F. Smirnov and K. V. Shitikova (Moscow State Univ.). Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1442-50(Nov. 1963). (In Russian)

A genealogical coefficient formalism was developed for a translation-invariant shell model. The wave function of the model, as in a real nucleon motion function, is a function of 3(A-1) coordinates (the nuclear center-of-mass motion is not considered because it is described by a plane wave), while in the ordinary shell model the wave motion is a function of all three coordinates, i.e., it contains three extra center-of-mass coordinates. (R.V.J.)

9347 INVESTIGATION OF $Li^6(d,\alpha)He^4$ REACTION AT DEUTERON ENERGIES OF 1 TO 2.5 Mev. Yu. P. Antuf'ev, M. M. El-Shesheni, Kh. R. Soad, Z. A. Salch, and P. V. Sorokin. Izv. Akad. Nauk SSSR, Ser. Fiz., 27: 1451-5(Nov. 1963). (In Russian)

Angular and energy distributions of α particles from $Li^6(d,\alpha)$ reactions at low deuteron energies were investigated using a 400-channel pulse analyzer. A typical charged particle spectrum at 120° and $E_d = 1.5$ Mev was developed. The results were correlated with published data based on capture interactions in the cluster model for $Li^6(He^4 + d)$. (R.V.J.)

9348 INVESTIGATION OF CONVERSION ELECTRONS Hg^{198} USING A β SPECTROMETER WITH $\pi\sqrt{2}$ FOCUSING. S. V. Starodubtsev, R. V. Begzhanov, and S. L. Rakovitskii (Inst. of Physics and Tech., Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 2, 44-8(1963). (In Russian)

A double-focusing β spectrometer was used for measuring conversion lines with continuous spectrum background. The spectrometer was capable of focusing from 5.6 kev to 3.7 Mev electrons. The constant λ for the known k line of Hg^{198} at 411.8 kev was 3862.62 ± 1.28. An attempt was made to achieve maximum resolving power for electron conversion on shells and subshells in $Ag^{198} \rightarrow Hg^{198}$ decay. A 0.6 × 15 mm, 0.28 mg/cm² gold foil was used as a source. The half life of Au^{198} was determined to be 2.687 ± 0.005 days. Internal conversion on K, L, M, and N shells at $h\nu$ = 411.8 kev was calibrated. It is shown that Hg^{198} transitions at 411.8 kev are electric quadrupoles. (R.V.J.)

9349 DETERMINATION OF LIFE-TIME FOR THE FIRST EXCITATION LEVEL OF Fe^{56}. R. B. Begzhanov, A. A. Islamov, D. K. Kaipov, and Yu. K. Shubnyi (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz, SSR, Ser. Fiz.-Mat. Nauk, No. 2, 49-55 (1963). (In Russian)

Resonance scattering of γ quanta in Fe^{56} at 0.845 Mev was studied using annular and plane geometry and a self-absorption method using gaseous $MnCl_2$($T_{\frac{1}{2}}$ Mn^{56} = 2.56 hrs). The experimental lifetime for Fe^{56} at 0.845 Mev was 9.5×10^{-12} sec. (R.V.J.)

9350 DEUTERON SPLITTING IN INELASTIC SCATTERING. E. Ismatov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 73-4(1963). (In Russian)

Cross sections for deuteron splitting in reactions with nonspherical nuclei, followed by nuclear rotational-state excitation, was studied. The cross section of the process was evaluated using an analogy with inelastic deuteron scattering. (R.V.J.)

9351 THE THEORY OF ROTATIONAL STATE OF NONAXIAL ODD NUCLEI. Sh. Sharipov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 4, 50-2(1963). (In Russian)

Rotational states of nonaxial odd nuclei were investigated by postulating that the nuclear shape is characterized by fixed equilibrium values for β deformation and γ nonaxiality, while the odd nucleon is in a state with a definite complete moment $j = {}^3/_2$. The spin and energy of Ir^{189} and Ir^{191} are analyzed. (R.V.J.)

9352 INTERPRETATION OF THE NATURE OF γ QUANTA ACCOMPANYING $Ta^{182} \rightarrow W^{182}$ DECAY. S. V. Starodubtsev, R. B. Begzhanov, and S. L. Rakovitskii (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 4, 70-8 (1963). (In Russian)

Additional data were developed for W^{182} γ transition based on internal conversion measurements. Ratios of γ transition probabilities were calculated in order to verify various theoretical models. A double-focusing $\pi\sqrt{2}$ β spectrometer was used for measuring K-line γ emission by Hg^{198} at 411.8 kev. Conversion spectra were measured at 800 to 1000 and 1000 to 1300 kev. The results indicated most of the W^{182} transitions previously reported. Transition energies for K and L conversion lines were determined with an accuracy of 0.05%. Mean values for the transitions are tabulated. At 1221 kev the transition is E2 passing between 2^+ and 0^+ levels. The multiplicities were determined by comparing experimental KβK with theoretical multiplicities. A decay scheme was constructed on the basis of data published by Murrey (Phys. Rev. 97, 1007, 1955) and Ryde (Arkiv for Fysik, 20, 289, 1961). (R.V.J.)

9353 FAST-NEUTRON CROSS SECTIONS AND LEGENDRE EXPANSION COEFFICIENTS FOR OXYGEN-16. G. D. Joanou (General Atomic Div., General Dynamics Corp., San Diego, Calif.) and H. French. J. Nucl. Energy Pt. A & B, 17: 425-34(Dec. 1963).

Cross sections for fast neutron reactions with oxygen-16 and elastic scattering angular distributions are given up to 15 Mev. Calculations are made of angular distributions at 1.75 to 2.15 Mev. The Legendre expansion coefficients are given for elastic scattering cross sections for 0 to 15 Mev. 22 references. (R.E.U.)

9354 MEASUREMENTS AT 14 Mev NEUTRON ENERGY OF THE n,2n CROSS SECTION OF BERYLLIUM AND THE n,3n CROSS SECTION OF THORIUM. M. H. McTaggart and H. Goodfellow (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Nucl. Energy, Pt. A & B, 17: 437-9(Dec. 1963).

Multiplication measurements with beryllium and thorium shells around a 14-Mev neutron source are reported. The basic relation between neutron multiplication (M), neutron transmission (T), and the number (η) of secondaries produced in each inelastic process is used to determine T for beryllium and hence the total inelastic and (n,2n) cross sections. It is also used to determine η for thorium, from which the (n,3n) cross section is estimated. (R.E.U.)

9355 INVESTIGATION OF THE REACTION $Ar^{40}(p,\gamma)K^{41}$. Isao Kohno (Electrotechnical Lab., Tokyo). J. Phys. Soc. Japan, 18: 1709-15(Dec. 1963).

The $Ar^{40}(p,\gamma)K^{41}$ reaction was studied in the range of proton energies from 750 to 1450 kev using a thin Ar^{40}

target prepared by a method of electromagnetic mass separation. 66 excited levels in K^{41} were observed. Gamma rays from the reaction were studied at the six resonances occurring at E_p = 1091, 1106, 1112, 1123, 1311, and 1391 kev using a NaI crystal scintillation spectrometer. In the nucleus K^{41}, levels at 0.98, 1.29, 1.58, and 8.5 ~ 9.2 Mev were observed. Spins of 1.58, 8.864, and 8.879-Mev levels were assigned as 3/2, 5/2, and 3/2, respectively, from the angular distributions of gamma rays. (auth)

9356 NON-RESONANT RADIATION FROM THE $N^{14}(p,\gamma)$ REACTION. G. M. Bailey and D. F. Hebbard (Australian National Univ., Canberra). Nucl. Phys., 46: 529-39(Sept. 1963).

A measurement at a proton energy of 800 kev shows that the non-resonant radiation in the $N^{14}(p,\gamma)$ reaction is made up of transitions through the 6.79-Mev state (55 ± 3%), 6.15-Mev state (17 ± 3%), 5.2-Mev state(s) (9 ± 3%), and ground state (19 ± 3%). The angular distribution of gamma rays to the 6.79-Mev state ($P_0 - (0.97 \pm 0.03)P_2$) is close to that expected for a p to s-wave direct capture transition, and is inconsistent with s-wave resonant capture to any broad level. Angular distributions are also measured for the ground-state transition and the high-energy members of the cascades. All these gamma rays are distributed isotropically, within experimental error. (auth)

9357 ENERGY LEVELS OF B^9. L. G. Earwaker, J. G. Jenkin, and E. W. Titterton (Australian National Univ., Canberra). Nucl. Phys., 46: 540-4(Sept. 1963).

A search for energy levels of B^9 was made by observing the α particles from the $B^{10}(He^3,\alpha)B^9$ reaction at a number of angles and over a range of bombarding energies from 3.0 to 10.5 Mev. Alpha particle groups leading to the ground state and the well-established states of B^9 at 2.34 and 2.81 Mev were observed, but no evidence for other levels of B^9 between the ground state and 10-Mev excitation energy was found. (auth)

9358 ANALYSIS OF DIRECT (n,p) REACTIONS. A. Agodi, R. Giordano, and G. Schiffrer (Università, Catania, Italy). Nucl. Phys., 46: 545-58(Sept. 1963).

A simple picture is given for direct (n,p) reactions, based on the distorted-wave Born approximation and on a single-particle model of the target and residual nuclei. Several angular distribution curves were calculated in the zero-range approximation for the reaction $Si^{28}(n,p)Al^{28}$, induced by 14-Mev neutrons and leading to the ground state and to the first excited state of the residual nucleus. It is shown that these two transitions give rise to the same angular distribution and the cross sections are in the ratio $\sigma_1/\sigma_2 = (2J_1 + 1)/(2J_2 + 1)$, where J_1 and J_2 are the total angular momenta of the two states. The agreement with the experimental data is rather poor for any reasonable choice of the optical model and bound states parameters. It is shown that the striking difference between the Born approximation and the distorted-wave Born approximation curves can be explained in terms of a definite change in the relation between linear and angular momentum transfer. (auth)

9359 ELECTROMAGNETIC DECAY OF THE SECOND EXCITED STATE OF C^{12}. P. A. Seeger and R. W. Kavanagh (California Inst. of Tech., Pasadena). Nucl. Phys., 46: 577-97(Sept. 1963).

The fraction of C^{12} nuclei in the second excited state that decay electromagnetically to the ground state (instead of by alpha-particle emission) was measured. The state was formed with the reaction $N^{14}(d,\alpha)C^{12*}$, and the recoiling C^{12} nuclei were observed in coincidence with the alpha particles from the reaction. The alphas were detected with a surface-barrier counter set at the appropriate angle determined by kinematics, and the recoiling nuclei at 90° were analyzed in momentum with a magnetic spectrometer, in energy by a surface-barrier counter at the spectrometer focus, and in velocity by the time delay between the alpha and the C^{12} counts. Pairs of pulses of 40 nsec width were recorded photographically from a dual-beam oscilloscope, providing a time resolution of 5 nsec, and also allowing pulse-height analysis on the fast pulses. Of the C^{12} nuclei formed in the second excited state, 99.9+% decay by alpha emission to Be^8 are are not detected; only those that decay to the C^{12} ground state by gamma or pair emission can be seen. Thus the experiment provides a direct measurement of Γ_{rad}/Γ, where $\Gamma_{rad} = (\Gamma_\gamma + \Gamma_{e\pm})$. Analysis of 170 observed events gives $\Gamma_{rad}/\Gamma = (2.8 \pm 0.3) \times 10^{-4}$. Averaged with a value $\Gamma_{rad}/\Gamma = (3.3 \pm 0.9) \times 10^{-4}$ obtained by Alburger, and combined with a value of $\Gamma = (8 \pm 5)$ ev determined from the investigations of Fregeau, of Alburger, and of Ajzenberg-Selove and Stelson, the result is $\Gamma_{rad} = (0.0024 \pm 0.0015)$ ev. This value is 2½ times the value used in previous astrophysical calculations of the rate of C^{12} formation in the helium-burning process in red giant stars, and yields an energy generation $\epsilon_{3\alpha} = 600$ f erg · g^{-1} sec^{-1} from 3 $He^4 \rightarrow C^{12}$ at $T = 10^8$°K and $\rho = 10^5$ g · cm^{-3}, where f is a screening correction factor of approximately 2. (auth)

9360 EFFECTIVE MASS IN NUCLEI. G. E. Brown (NORDITA, Copenhagen), J. H. Gunn, and P. Gould. Nucl. Phys., 46: 598-606(Sept. 1963).

Calculations in finite nuclei indicate that in the region of bound particles ≈ –8 to 0 Mev the velocity dependence of the shell model is, if present, opposite to that usually assumed. This can be expressed by saying that the ratio of the effective mass to the real mass is equal to or greater than unity in this energy range. (auth)

9361 EFFECT OF PION MASS DIFFERENCES ON THE VECTOR COUPLING CONSTANT IN β-DECAY. V. S. Mathur, R. P. Saxena, G. C. Joshi, and J. S. Mathur (Univ. of Delhi). Nucl. Phys., 46: 607-10(Sept. 1963).

In an attempt to understand the difference between the n-p vector coupling constant g_V and the μ-decay coupling constant g_μ a partially conserved model for n-p vector current is proposed that incorporates the effects of pion mass differences. An estimate based on renormalized Born approximation gives $g_V/g_\mu = 0.96$. (auth)

9362 SYMMETRICAL SHAPES OF EQUILIBRIUM FOR A LIQUID DROP MODEL. V. M. Strutinskii, N. Ya. Lyashchenko, and N. A. Popov (Kurchatov Inst. of Atomic Energy, Moscow). Nucl. Phys., 46: 639-59(Sept. 1963).

Results of the calculation of the symmetrical nuclear equilibrium shapes are presented. An integro-differential equation for equilibrium shapes is solved by an iteration method. (auth)

9363 SINGLE EXCITATIONS IN MASS-EIGHT NUCLEI. G. F. Nash (Wadham Coll., Oxford). Nuovo Cimento (10), 30: 1064-72(Nov. 16, 1963).

The single excitations in mass-eight nuclei are classified according to the SU3 coupling scheme, and the mean energies of the low-lying states computed. Three dipole states are found to exist in beryllium, one corresponding to a longitudinal oscillation along the axis of symmetry, and two to transverse vibrations. The division of dipole strength from the ground state to these excited states is calculated. (auth)

9364 THE HYPERFINE SPLITTING OF THE GROUND STATE OF Tm^{169}. D. L. Kaminskii, K. M. Novik, N. I. Alekseev, and L. S. Varshalovich. Opt. Spectry. (USSR) (English Transl.), 15: 239-41(Oct. 1963).

The Zeeman effect of the ground state of Tm^{169} was studied by the atomic beam-magnetic resonance method. The hyperfine splitting was measured. The magnetic dipole interaction constant was found to be $a = -[374.147 \pm 0.005]$ Mc, giving a magnetic moment of $\mu_I = -0.25$ nuclear magneton. The Landé factor was found to be $g_J = -[1.1412 \pm 0.0001]$. (auth)

9365 STUDY OF HYPERFRAGMENTS PRODUCED IN 800 Mev/c K^- INTERACTIONS. II. NONMESIC DECAYS OF LIGHT HYPERFRAGMENTS. I. R. Kenyon, A. Z. M. Ismail, A. W. Key, S. Lokanathan, and Y. Prakash (Oxford Univ.). Nuovo Cimento (10), 30: 1365-78(Dec. 16, 1963).

Nonmesic to π^- mesic decay ratios for helium hyperfragments and for those with $Z \geq 3$ were obtained. A lower limit for the branching ratio of the decay modes $_\Lambda He^5 \rightarrow n + p + He^3$ and $_\Lambda He^5 \rightarrow n + n + H^3$ was given. (auth)

9366 EXCITED LEVELS IN ^{77}Se FROM THE DECAY OF ^{77}Br. S. Monaro (Brookhaven National Lab., Upton, N. Y.). Nuovo Cimento (10), 30: 1379-95(Dec. 16, 1963). (BNL-7103)

The decay of 58 h Br^{77} was investigated with scintillation spectrometers, coincidence techniques, and angular correlations. Sixteen gamma transitions are found to occur between states in Se^{77} with the following energies, and probable spins and parities: ground state ($\frac{1}{2}^-$), 161 kev ($\frac{7}{2}^-$), 242 kev ($\frac{3}{2}^-$), 248 kev ($\frac{5}{2}^-$), 440 kev ($\frac{5}{2}^-$), 515 kev ($\frac{3}{2}^-$), 820 kev ($\frac{3}{2}^-$), and 1000 kev ($\frac{3}{2}^-$). The half-life of the weakly excited upper state at about 248 kev, of the doublet near 245 kev in Se^{77}, was measured by means of delayed coincidence method; the result was $(9.7 \pm 0.8) \times 10^{-9}$ s. The way in which the states of this doublet are excited and de-excited was investigated. It was found that the 248-kev upper level of the doublet de-excites by transitions to the ground state and to the 161-kev isomeric state in Se^{77}, with a branching ratio of 1.6 ± 0.4. (auth)

9367 ON THE LOW-ENERGY SPECTRUM AND THE γ-DECAY PROBABILITIES OF ^{114}Cd. E. Salusti (Institut du Radium, Orsay, France). Nuovo Cimento (10), 30: 1478-86(Dec. 16, 1963).

The low-energy spectrum and the γ-decay probabilities for Cd^{114} were calculated. The method used is derived from those of the theory of the superconductivity. For the residual interaction between the nucleons outside the closed shells, a pairing plus quadrupole force was assumed. A reasonable agreement with the experimental data is obtained. (auth)

9368 POSSIBLE ROLE OF THE Y_0^* IN THE HYPERFRAGMENT FORMATION. M. D. Warty (Univ. of Delhi). Nuovo Cimento (10), 30: 1565-7(Dec. 16, 1963).

The possible role of the Y_0^* in hyperfragment formation is discussed. The percentage of $K^- - 2N$ interactions in a nucleus was determined from the probability of the Y_0^* hitting one of the nucleons. The results were in fairly good agreement with experiment and it was shown that the percentage increases with increasing mass number of the nucleus. (C.E.S.)

9369 AN EXPERIMENTAL SEARCH FOR β-DECAY RATE CHANGES WITH HIGH CENTRIFUGAL FORCES. B. I. Deutch (Universitet, Aarhus, Denmark) and T. R. Gerholm. Nuovo Cimento (10), 30: 1570-1(Dec. 16, 1963).

A centrifuge is used to simulate gravitational forces in an investigation of gravitational effects on the beta-decay rate of Hg^{203}. It is concluded that within the accuracies of the determination, no measurable changes in beta-decay rates are observed at centrifugal forces of about 4×10^5 g. (C.E.S.)

9370 STUDY OF THE REACTION $Li^6(\alpha,d_0)Be^8$ AT MEDIUM ENERGIES. G. Deconninck and G. Demortier (Centre de Physique Nucléaire, Louvain, Belg.). Phys. Letters, 7: 260-1(Dec. 1, 1963). (In French)

The cross-section fluctuation and angular distributions were studied at α-particle energies of 24.5, 23.7, 22.9, and 20.5 Mev. (R.E.U.)

9371 SPACING OF NUCLEAR MASS SURFACES AND THE SUPERFLUID MODEL OF NUCLEI. V. Canuto (Instituto Politécnico Nacional, Mexico City) and M. Bauer. Phys. Letters, 7: 261-3(Dec. 1, 1963).

It is shown that the superfluid model of nuclei naturally gives rise to Levy's rule for δ, the pairing energy, which states that $\delta = 0$ for even-even, $-\frac{1}{2}\,\Pi_N$ for odd-N, $-\frac{1}{2}\,\Pi_Z$ for odd-Z, and $-\frac{1}{2}\,\Pi_N - \frac{1}{2}\,\Pi_Z + I$ for odd-odd nuclei, where Π_N and Π_Z have a shell dependence. (R.E.U.)

9372 CHARGE DISTRIBUTION OF Li^6. E. W. Schmid (Max-Planck-Institut für Physik und Astrophysik, Munich); Y. C. Tang, and K. Wildermuth. Phys. Letters, 7: 263-5 (Dec. 1, 1963).

A variational calculation with a two-body potential was carried out to confirm qualitative arguments for the large diffuseness and large rms radius of Li^6 as arising from the long tail of the deuteron cluster, in the alpha-deuteron structure, and the fact that the clusters are widely separated. (R.E.U.)

9373 THE SHAPE OF THE SYMMETRY-TERM IN THE NUCLEAR OPTICAL POTENTIAL. T. Terasawa and G. R. Satchler (Oak Ridge National Lab., Tenn.). Phys. Letters, 7: 265-7(Dec. 1, 1963).

The shape of the optical potential is discussed with a term proportional to $\underline{t}_0 \cdot \underline{T}$ included, where $\underline{t}_0$ and $\underline{T}$ are the $\underline{i}$-spin operators for projectile and target. It is shown that the symmetry potential can be expected to be strongest at the nuclear surface. (R.E.U.)

9374 THE SHAPE OF THE IMAGINARY NUCLEAR OPTICAL POTENTIAL. H. F. Lutz, J. B. Mason, and S. F. Eccles (Univ. of California, Livermore). Phys. Letters, 7: 268-9(Dec. 1, 1963). (UCRL-7501)

The effects of pairing correlations and the imaginary potential well at the nuclear surface are applied with volume absorption to the analysis of the elastic scattering of 19.2-Mev protons from Fe^{56}. The imaginary potential has a gaussian shape plus a constant volume contribution determined by the ratio of the volume contribution to the peak of the gaussian. It is concluded that it is possible to fit elastic angular distributions using an imaginary form factor that agrees fairly well with the theoretical prediction, but that the elastic data alone is not sufficient to determine the shape of the imaginary potential. (R.E.U.)

9375 PHOTOPROTONS FROM O^{16} MEASURED LOW WITH A SOLID STATE DETECTOR TELESCOPE. J. A. Scheer, K. Schluepmann, and F. Triantafyllidis (Universität, Heidelberg). Phys. Letters, 7: 269-70(Dec. 1, 1963).

A totally depleted silicon detector was placed above a lithium-drifted detector and beneath the center of the bremsstrahlung beam from a betatron. A dE/dX-E counter telescope was used to suppress the large γ-ray background. The spectrum of protons at 6 to 18 Mev was studied for $O^{16}(\gamma,p)N^{15}$. (R.E.U.)

9376 ON THE REACTION $He^3(\gamma,p)D$. E. Finckh, R. Kosiek, K. H. Lindenberger, U. Meyer-Berkhout, N. Nuecker, and K. Schluepmann (Universität, Heidelberg). Phys. Letters, 7: 271-2(Dec. 1, 1963).

Two CsI(Tl) scintillation spectrometers were used as detectors and were mounted rectangularly to the direction of the γ-beam. The two-body disintegrations were separated and the cross section was determined. (R.E.U.)

9377 LEVELS IN Al^{27} BELOW 2.21 Mev. B. H. Armitage (Atomic Energy Research Establishment, Harwell, Berks, Eng.); J. H. Montague, A. K. M. Siddiq, and R. E. Meads. Phys. Letters, 7: 274-6(Dec. 1, 1963).

An attempt is made to confirm the existence of new states in Al^{27} at 1.65 and 1.83 Mev, both by γ-γ coincidences produced in Mg^{27} decay and by proton inelastic scattering by Al. (R.E.U.)

9378 ABSENCE OF TENSOR TERM IN THE OPTICAL MODEL FOR THE d–Ca ELASTIC SCATTERING AT 22 Mev. J. Raynal (Centre d'Etudes Nucléaires, Saclay, France). Phys. Letters, 7: 281-3(Dec. 1, 1963).

The tensor terms in the optical potential for the elastic scattering of deuterons are absent according to the results obtained. The fit of the cross section for the target was poor. A central potential and LS coupling are considered in trying to fit the cross section. (R.E.U.)

9379 REMARKS ON MIXED SYMMETRY STATES AND THE NUCLEAR PHOTO-EFFECT IN He^3 AND H^3. P. O. Davey and H. S. Valk (Univ. of Nebraska, Lincoln). Phys. Letters, 7: 335-6(Dec. 15, 1963).

A relation between the mean square charge radius, R_c^2, for point nucleons and the main square separation of the center of mass of the proton and neutron distribution, $\langle R_{pn}^2 \rangle$, is used to show that states other than the full spatial symmetry can be inferred from electron scattering data. The admixture of s' present in the ground state wave function is determined from measurements of the bremsstrahlung-weighted E1 photoabsorption cross section, $\sigma_b(He^3)$ and $\sigma_b(H^3)$. (L.B.S.)

9380 AN EXPERIMENTAL STUDY OF THE ATTENUATION IN GAMMA-GAMMA ANGULAR CORRELATIONS. F. C. Zawislak, D. E. Frandão, A. Vasquez, and F. P. Livi (Universidade do Rio Grande do Sul, Porto Alegre, Brazil). Phys. Letters, 7: 337-8(Dec. 15, 1963).

A deviation from the simple exponential time dependence of the angular coefficients was found from measurements of the time-dependent angular correlation of the 133 to 482 kev $(1/2^+ - 5/2^+ - 7/2^+)$ states in Ta^{181} resulting from the beta-decay of Hf^{181}. A comparison of experimental data with calculated curves shows good agreement between theory and experiment. (L.B.S.)

9381 DIFFRACTION MECHANISM FOR DIRECT NUCLEAR REACTIONS. A. Dar (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Letters, 7: 339-41(Dec. 15, 1963).

The cross sections for elastic scattering of n, p, d, t, He^3, α, C^{12}, N^{14}, and O^{16} from various targets in the region above 10 Mev per particle were investigated and were found to exhibit diffraction behavior. The diffraction mechanisms are discussed. Diffraction curves for direct nuclear reactions such as stripping, heavy-particle stripping, pick up, knock out, and inelastic collisions are shown to fit the Butler curves and the experimental curves as well as optical model calculations. (L.B.S.)

9382 AN S-STATE INTERACTION WITH PAIRING-TYPE PROPERTIES IN THE NUCLEAR SHELL MODEL. S. P. Pandya (Argonne National Lab., Ill.). Phys. Letters, 7: 342-3(Dec. 15, 1963).

Pairing-type properties of the s-state interaction for which $I_{2s} \neq 0$, and $I_{1s} = I_{0s} = 0$ are discussed. The spectra of several four-particle configurations are evaluated and the results are presented in energy-level diagrams for T = 0 states and T = 2 states. (L.B.S.)

9383 NEW RESONANCES IN THE $K^{41}(p,\gamma)Ca^{42}$ AND $K^{39}(p,\gamma)Ca^{40}$ REACTIONS. L. Simons, K-E. Nysten, E. Spring, L. Kaeld, H. Jungner, P. Holmberg, and I. Forsblom (Univ. of Helsinki). Phys. Letters, 7: 344-6(Dec. 15, 1963).

A study of the yield of gamma rays from proton bombardment of potassium, at 1050 to 1200 kev, was made. Yield curves of the $K^{41}(p,\gamma)Ca^{42}$ and $K^{39}(p,\gamma)Ca^{40}$ reactions, which demonstrate resonances not previously known to exist, are presented and results are tabulated. (L.B.S.)

9384 LIFETIME OF THE FIRST EXCITED STATE OF F^{19}. N. H. Gale (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and J. M. Calvert. Phys. Letters, 7: 348-9(Dec. 15, 1963).

The lifetime of the 110-kev, 1/2-first excited state of F^{19} was measured using the pulsed-beam technique. The mean life obtained is $(9.2 \pm 0.4) \times 10^{-10}$ sec, which is in good agreement with previous determinations. (L.B.S.)

9385 THREE-NUCLEON SYSTEMS. B. K. Srivastava (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 133: B545-9 (Feb. 10, 1964).

A preliminary calculation of the bare form factor $F_B(q^2)$ for the three-nucleon systems H^3 and He^3 with the wave function $\psi = N \exp[-(\kappa/2)(r_{12} + r_{23} + r_{13})]$ was made. It is found that if κ is adjusted so as to fit the experimental value of the Coulomb energy for He^3, or to fit the bremsstrahlung-weighted integral cross section for the photoeffect of He^3, the agreement with experimental results for $F_B(q^2)$ is quite good. A variational calculation of the binding energy of the triton is made using two-body velocity-dependent central potentials and ψ as a trial function with κ as the adjustable parameter. Preliminary results show that the binding energy is much lower than the experimental value and that it is given by a static well-behaved potential, though it is in fairly good agreement with similar calculations using repulsive hard core potentials. (auth)

9386 NUCLEAR CORE POLARIZATION EFFECT ON BETA DECAY. Jun-ichi Fujita (Univ. of Washington, Seattle), Saburo Fujii, and Kiyomi Ikeda. Phys. Rev., 133: B549-55(Feb. 10, 1964).

It is shown that the neutron-hole and proton correlations play a significant role for beta decay in heavier nuclei. The effective coupling constant of beta decay is estimated by using a soluble model and experimental knowledge of (p,n) reactions. Systematics of f_0t values are re-examined qualitatively. (auth)

9387 DECAY OF THE 9.4-MIN AND 8.7-DAY ISOMERS OF Sn^{125}. S. H. Devare and H. G. Devare (Tata Inst. of Fundamental Research, Bombay). Phys. Rev., 133: B568-78(Feb. 10, 1964).

The decay schemes of the 9.4-min and 9.7-day isomers of Sn^{125} were studied using scintillation spectrometers and coincidence techniques. Gamma rays of energies 325, 585, 640, 830, 1070, 1390, 1470, 1610, 1720, and 1940 kev with relative intensities 130, 0.75, 0.40, 0.16, 0.17, 1.0, 0.58, 0.28, 0.08, and 0.07, respectively, were observed in the decay of the 9.4-min isomer while the decay of the 9.7-day isomer gives rise to gamma rays of energies 330, 470, 810, 910, 1075, 1165, 1410, 1985, and 2230 kev with relative intensities 0.23, 0.28, 1.0, 0.92, 2.81, 0.09, 0.09, 0.41, and 0.03, respectively. On the basis of the coincidences between the various gamma rays it is concluded that the 9.4-min

isomer excites levels in Sb^{125} at 325, 640, 910, 1470, 1720, and 1940 kev, whereas levels at 1075, 1410, 1885, 1985, and 2230 kev are excited in the decay of the 9.7-day isomer. Further evidence in support of these levels from total-absorption gamma spectra is also presented. Plausible spin and parity assignments to these levels have been made on the basis of the log ft values of the beta groups feeding these levels and also their decay modes. (auth)

9388 SLOW NEUTRON CAPTURE GAMMA RAYS IN Hg^{200}. R. E. Segel, R. K. Smither, and R. T. Carpenter (Argonne National Lab., Ill.). Phys. Rev., 133: B583-90 (Feb. 10, 1964).

Coincidence measurements on the gamma rays following slow neutron capture by Hg^{200} were made with thermal neutrons and at the 34-, 129-, and 175-ev resonances. The two new low-lying levels found at 1.05 and 1.27 Mev constitute the third and fourth excited states of Hg^{200}. These new states, together with the previously known second excited state, are shown to be consistent with a two-phonon vibrational triplet. Transitions to several other states were also observed. The transitions from the four capturing states to various low-lying states are summarized. (auth)

9389 STATES IN Si^{28} WITH $12.7 < E_x < 13.7$ Mev BY (α,γ) AND (α,α) REACTIONS ON Mg^{24}. J. A. Weinman, L. Meyer-Schuetzmeister, and L. L. Lee, Jr. (Argonne National Lab., Ill.). Phys. Rev., 133: B590-7(Feb. 10, 1964).

The radiative capture and elastic scattering of alpha particles by Mg^{24} were studied for alpha-particle energies between 3.2 and 4.5 Mev. The yield and angular distributions of the gamma radiation in combination with a dispersion analysis of the $Mg^{24}(\alpha,\alpha)Mg^{24}$ data gave information on the resonance energies, angular momenta, parities, and some partial widths of states in Si^{28}. The excitation energies and the corresponding spins and parities of the Si^{28} levels considered were: 12.74 Mev, 2^+; 12.82 Mev, [0^+ or 3^-]; 12.83 Mev, 1^-; 12.87 Mev, 4^+; 12.92 Mev, 2^+; 12.99 Mev, 1^- and 0^+ (two levels); 13.06 Mev, 0^+; 13.12 Mev, 2^+; 13.19 Mev, [?]; 13.25 Mev, 0^+, 13.27 Mev, [1^-]; 13.38 Mev, [?]; and 13.71 Mev, 2^+. (auth)

9390 ALPHA-PARTICLE-INDUCED FISSION OF Th^{230}, Th^{232}, AND U^{233}. H. C. Britt and S. L. Whetstone, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 133: B603-12(Feb. 10, 1964). (LADC-5942)

Measurements were made of the kinetic energies of coincident-fission fragment pairs emitted in the 22.1-, 25.7-, and 29.5-Mev He^4-induced fission of Th^{230}, Th^{232}, and U^{233} to determine the mass and total kinetic-energy distributions of the fragments. The results are found to be consistent with the hypothesis of two distinct fission modes, corresponding to predominantly symmetric and predominantly asymmetric mass divisions. From a comparison of the mass distributions obtained from double-energy measurements with the mass distributions obtained from double-velocity time-of-flight measurements, it is possible to deduce the average number of prompt neutrons emitted as a function of the fragment mass. These results are also found to be qualitatively consistent with the two-mode hypothesis. (auth)

9391 COINCIDENT TIME-OF-FLIGHT MEASUREMENTS OF THE VELOCITIES OF FISSION FRAGMENTS FROM CHARGED-PARTICLE-INDUCED FISSION. Stanley L. Whetstone, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 133: B613-24(Feb. 10, 1964). (LADC-5890)

Measurements were made of the velocities of the coincident fission fragment pairs emitted in the 25.7- and 29.5-Mev He^4-induced fission of U^{233} and Th^{230}, the 25.7- and 29.5-Mev He^4-induced fission of Th^{232}, and the 12.0- and 14.0-Mev H^2-induced fission of Th^{230}. Previously unpublished data for the 21.8-Mev He^4-induced fission of U^{233} and Th^{232} are also included. A decrease in average total fragment kinetic energy for symmetric mass division is observed in each case. The relatively large yield of symmetric mass divisions permits a reliable measurement of this effect. The distributions of fragment velocities, masses, and kinetic energies are consistent with the hypothesis of two competing modes of fission. A comparison is made of the primary mass yields obtained in this work with the yields obtained by radiochemical methods to determine the dependence of prompt neutron emission of fragment mass. The neutron emission found, although subject to poorly known and possibly large uncertainties in the radiochemical data, appears to show a rather pronounced structure of just such a nature as might be attributed to fragment-shell effects that persist to these high excitation energies. Such a structure is not observed, however, when the present primary mass data are compared with mass distributions derived from recent fragment double-energy measurements. The time-of-flight mass distributions were corrected for the influence of the prefission neutron emission and the detection solid angle. As a part of the correction, the dependences of the yield of symmetric mass divisions on the excitation energy of the fissioning nuclei were estimated for each of the target-projectile systems. (auth)

9392 LEVELS IN Dy^{164} FROM DEUTERON STRIPPING AND INELASTIC PROTON SCATTERING EXPERIMENTS. W. Neil Shelton and Raymond K. Sheline (Florida State Univ., Tallahassee). Phys. Rev., 133: B624-31(Feb. 10, 1964).

Protons and deuterons with energies 12.5 and 12.0 Mev, respectively, were used to study the levels in Dy^{164} at a number of angles via the reactions $Dy^{164}(p,p')Dy^{164}$ and $Dy^{163}(d,p)Dy^{164}$. The ground-state Q value for the latter reaction was determined as 5434 ± 5 kev. The agreement in energy between the proton groups observed in both reactions and the nuclear models of Bohr and Mottelson and Davydov allows the assignment of ground-state and gamma vibrational bands. These assignments are (in kev) G.S. (0+), 72 (2+), 240 (4+), 503 (6+), 761 (2+), 827 (3+), 919 (4+), 1040 (5+), and, with less certainty, 1157 (6+). Cross sections for excitation of the γ band by the (d,p) reaction are similar to those of the G.S. band, whereas no excitation of a β vibrational band is observed. The 6– two-quasiparticle state, formed from the coupling of the $\frac{5}{2}$– [523] and $\frac{7}{2}$ [633] neutron states, and the 7– member of the superimposed rotational band are probably the weak states at 1680 and 1853 kev, respectively. The 2+ two-quasiparticle state formed from the coupling of the $\frac{5}{2}$– [523] and $\frac{1}{2}$– [521] neutron states and the members of the associated rotational band were probably observed. They are: 1987 (2+), 2058 (3+), 2158 (4+), 2266 (5+), and 2418 (6+). The collective nature of the ground-state and γ vibrational bands in Dy^{164} is clearly indicated by very small cross sections for the (d,p) reactions and relatively large cross sections for the (p,p') reaction. The energy gap corresponding to breaking a neutron pair is observed as a dramatic increase in the (d,p) cross section. A useful selection rule for (d,p) stripping predicted by Satchler is clearly verified experimentally. (auth)

9393 POLARIZATION OF PROTONS PRODUCED IN THE STRIPPING OF DEUTERONS BY B^{10}, Si^{28}, AND Ca^{40}. R. W. Bercaw and F. B. Shull (Washington Univ., St. Louis, Mo.). Phys. Rev., 133: B632-8(Feb. 10, 1964).

The angular dependences of the polarization of protons

from the $B^{10}(d,p)B^{11}$, $Si^{28}(d,p)Si^{29}$, and $Ca^{40}(d,p)Ca^{41}$ reactions were measured using 10-Mev deuterons. The polarizations in all of these reactions were found to exceed the limits set by the central potential distorted wave Born approximation. The polarizations of protons resulting from the $B^{10}(d,p)B^{11*}$ reactions were also measured at a few angles. (auth)

9394 EXCITATION FUNCTION FOR THE $C^{12}(\pi^-, \pi^-n)C^{11}$ REACTION. Paul L. Reeder and Samuel S. Markowitz (Univ. of California, Berkeley). Phys. Rev., 133: B639-46(Feb. 10, 1964). (UCRL-10924)

The excitation function for the reaction $C^{12}(\pi^-,\pi^-n)C^{11}$ was measured from 53 to 1,610 Mev by bombarding targets of plastic scintillator with pions. The intensity of the pion beam was monitored with a two-counter telescope and 40-Mc scaling system. The scintillator target was mounted on a phototube and became the detector for the C^{11} positron activity. Corrections were made for muon contamination in the beam, coincidence losses in the monitor system, C^{11} activity produced by stray background at the accelerator, C^{11} activity produced by secondaries in the target, and the efficiency of the C^{11} detection system. The $C^{12}(\pi^-,\pi^-n)C^{11}$ cross sections rise from a threshold at about 50 Mev to a peak of about 70 mb at 190 Mev after which they decrease to 30 mb at 373 Mev and are relatively constant at higher energies. The (π^-,π^-n) peak occurs at the same energy as the resonance in free-particle π^-n scattering at 190 Mev. Calculations based on a knock-on collision mechanism and sharp-cutoff nuclear density reproduce the shape of the experimental excitation function, but the magnitudes of the calculated cross sections are low by a factor of about 5 or 6. This simple model indicates that the $C^{12}(\pi^-,\pi^-n)C^{11}$ reaction occurs in the nuclear surface region at all bombarding energies. (auth)

9395 $O^{16}(p,\alpha)N^{13}$ AND $O^{16}(p,p')O^{16}$ DIFFERENTIAL CROSS SECTIONS. R. L. Dangle, L. D. Oppliger, and G. Hardie (Univ. of Wisconsin, Madison). Phys. Rev., 133: B647-59(Feb. 10, 1964). (TID-19372)

The differential cross sections for the inelastic scattering of protons by O^{16} and for the $O^{16}(p,\alpha)N^{13}$ reaction were measured for E_p from 7.18 to 12.90 Mev. A differentially-pumped gas scattering chamber with a solid-state detector was used. Data at $\theta_{lab} = 166°\ 00'$ were taken in energy steps ≤5 kev and with a target thickness ≤3 kev. Seven other excitation curves were taken for $7.18 \leq E_p \leq 10.5$ Mev at $\theta_{lab} = 133°\ 48'$, 116° 34', 100° 19', 86° 24', 61° 36', 51° 25', and 33° 47'. These curves were taken with energy steps ≤23 kev depending upon the width of the resonance structure. The target thickness was ≤3 kev. Data were obtained on the alphas leaving N^{13} in its ground state and on the inelastic protons leaving O^{16} in its first, second, third, and fourth excited states. Evidence was found for the existence of 36 levels in F^{17}, the compound nucleus. Below $E_p = 10.5$ Mev, center-of-mass angular distributions were picked from the eight excitation curves and fitted with Legendre polynomials. Levels in F^{17} at the following excitation energies were assigned total widths, spins, and parities as indicated: $E_x = 7.73$ Mev, $\Gamma_{cm} = 0.178$ Mev, $J^\pi = 1/2^+$; 8.07, 0.104, $5/2^+$; 8.2, 0.706, $3/2^-$; 8.38, 0.011, $5/2^-$; 8.42, 0.042, $1/2^+$; 8.72, 0.188, $5/2^+$; 8.95, 0.122, $5/2^-$; 9.16, 0.188, $3/2^+$; 10.05, 0.282, $7/2$. All parity assignments except those for the levels at $E_x = 8.95$ and 9.16 Mev are based on the assumption that the F^{17} level at $E_x = 8.2$ Mev is the mirror of the $3/2^-$ level in O^{17} at $E_x = 7.72$ Mev. (auth)

9396 ENERGY AND ANGULAR DISTRIBUTION OF PHOTONEUTRONS FROM OXYGEN-18. Said F. Mughabghab and W. E. Stephens (Univ. of Pennsylvania, Philadelphia). Phys. Rev., 133: B660-2(Feb. 10, 1964).

The energy and angular distribution of photoneutrons from $O^{18}(\gamma,n)O^{17}$ are investigated. An O^{18} target enriched to 90% is irradiated with bremsstrahlung of 20-Mev maximum energy. The photoneutrons are detected by recoil protons in nuclear emulsions at angles between 30 and 150° with the beam. Distinct peaks in the neutron spectrum at 1.3, 3.1, 7.4, and possibly at 1.7, 5.5, 9.2, and 10.5 Mev are observed. The peaks at 1.3 and 3.1 Mev can be accounted for in terms of single-particle excitation modes ($2S_{1/2} \rightarrow 2P_{3/2,1/2}$) of a valence neutron without disturbing the O^{16} core. These correspond to 1^- levels in O^{18} at 10.3 and 12.2 Mev with transitions leaving O^{17} in the $1/2^+$ excited state at 0.871 Mev. The angular distribution of the neutrons is predominantly $\sin^2\Theta$ at low energies. At high energies, there is an indication of interference effects between electric dipole and quadrupole absorption. (auth)

9397 PHOTODISINTEGRATION OF U^{235}. C. D. Bowman, G. F. Auchampaugh, and S. C. Fultz (Univ. of California, Livermore). Phys. Rev., 133: B676-83 (Feb. 10, 1964). (UCRL-7481)

The photodisintegration of U^{235} was studied, using nearly monochromatic photons obtained from the annihilation in flight of fast positrons. The partial cross sections $\sigma(\gamma,F)$, $\sigma(\gamma,n)$, and $\sigma(\gamma,2n)$ were determined. Integrated cross sections for these reactions were found to be 1.07, 1.00, and 1.49 Mev·b, respectively. Structure in the giant resonance of the compound-nucleus-formation cross section was observed and from this a quadrupole moment of 12.8 ± 1.3 b was found. An energy dependence in the quantity Γ_n/Γ_f was observed. (auth)

9398 REACTIONS INDUCED IN Fe^{54} WITH 21–63 Mev Li^6 IONS. Marshall Blann, Frank M. Lanzafame, and R. Amelia Piscitelli (Univ. of Rochester, N. Y.). Phys. Rev., 133: B700-6(Feb. 10, 1964).

Excitation functions were measured for the production of Ni^{56}, Ni^{57}, Co^{55}, Co^{56}, Co^{57}, Co^{58}, Fe^{52}, Fe^{55}, and Mn^{54} from Fe^{54} bombarded with Li^6 ions of 21–63-Mev kinetic energy. The targets were enriched to 95% Fe^{54}. Excitation functions for the production of Ni^{57}, Co^{55}, Co^{56}, Co^{57}, Fe^{55}, and Mn^{54} resulting from Li^6 bombardment of Fe^{54} and deuteron bombardment of Ni^{58} are compared. Of these, excitation functions for the production of Ni^{57}, Co^{57}, and Mn^{54} are mutually consistent with decay of a Cu^{60} compound nucleus. Excitation functions for production of Co^{55} and Fe^{55} with the two projectiles appear to proceed by different mechanisms. The Co^{56} excitation functions in the two target-projectile systems are not directly comparable, since the probable reactions producing Co^{56} are $Ni^{58}(d,\alpha)Co^{56}$ and $Fe^{54}(Li^6,2p2n)Co^{56}$. All excitation functions studied in the $Fe^{54} + Li^6$ system show the competitive behavior of compound-nucleus reactions with the exception of the high-energy tail of the Co^{58} excitation function (apparently due to 5% Fe^{56} impurity in the targets) and the low-energy portions of the Co^{55} and Fe^{55} excitation functions. The very low yields observed for the production of Ni^{56} and Ni^{57} are attributed to the effect of the 28-nucleon shells on nuclear level densities. The sum of measured cross sections from $Fe^{54} + Li^6$ reactions is compared with calculated optical-model nonelastic cross sections. (auth)

9399 STATISTICAL ANALYSIS OF REACTIONS INDUCED WITH 21–63 Mev Li^6 IONS ON Fe^{54}: EFFECTS OF ANGULAR MOMENTUM AND CLOSED SHELLS ON NUCLEAR LEVEL DENSITIES. Marshall Blann (Univ. of Rochester, N. Y.). Phys. Rev., 133: B707-13(Feb. 10, 1964).

Two sets of statistical theory calculations were compared with experimental excitation functions for the production of Ni^{56}, Ni^{57}, Co^{56}, Co^{57}, Mn^{54}, and Fe^{52} at excitation energies up to 70 Mev. The reactions were induced with Li^6 ions on Fe^{54}. The first set of calculations was based on the assumption that $\rho(E,J) = C(2J+1)\rho(E)$, where $\rho(E) = C'E^{-2}\exp 2(aE)^{\frac{1}{2}}$. The excitation energy E was corrected for pairing a was taken equal to 7.0 Mev^{-1} as determined from (p,α) and (α,α') spectra, and optical-model nonelastic cross sections were used for inverse reaction cross sections. All permutations of n, p, d, t, He^3, and α emission were calculated for the first two particles out, followed by all permutations of n, p, and α emission for further evaporation. The excitation functions so calculated were narrower, and peaked at lower excitation energies than the experimental excitation functions. A second set of calculations was made assuming $\rho(E,J) = C'(2J+1)\rho(E - \overline{E}_{rotational})$, where the average rotational energy, assumed to remain constant throughout the series of intermediate nuclei involved in a particle emission cascade, was calculated with the use of optical-model transmission coefficients for Li^6 ions incident on Fe^{54}. Excitation functions calculated with the latter assumption are in excellent agreement with experimental values with respect to width and excitation energy of maxima. Neither set of calculations is in good agreement with experimental values with respect to magnitude of maxima. It is suggested that these discrepancies may partially be explained as due to the influence of the 28-neutron and 28-proton shells on nuclear level densities. (auth)

9400 DIRECTIONAL CORRELATION OF FISSION FRAGMENTS AND PROMPT GAMMA RAYS ASSOCIATED WITH THERMAL NEUTRON FISSION. Marvin M. Hoffman (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 133: B714-23(Feb. 10, 1964).

Prompt fission γ-ray intensity as a function of the angle from the fragment direction was measured for the thermal neutron fission of U^{233}, U^{235}, and Pu^{239}. For each of these three nuclides, the fission γ rays were found to be emitted preferentially in the direction of fragment motion by as much as 15%. It was found that the experimental data were best fitted by assuming that γ rays emitted by fission fragments have two components with different angular distributions. One component, accounting for about 85% of the γ rays, was isotropic about the fission fragment direction. The remaining 15% had the angular distribution of γ rays from quadrupole transitions of nuclei having approximately 7 units of angular momentum distributed in, or near, a plane perpendicular to the direction of fragment motion. A calculation of the torque resulting from electrostatic forces between the fission fragments is discussed. Results of this calculation indicate that these electrostatic forces could give rise to the fragment rotations indicated by the γ-ray measurements. (auth)

9401 LONG-RANGE PARTICLE EMISSION IN COINCIDENCE WITH FISSION AT MODERATE EXCITATION ENERGIES. J. A. Coleman and A. W. Fairhall (Univ. of Washington, Seattle). Phys. Rev., 133: B724-31(Feb. 10, 1964).

The production rate of long-range particles in coincidence with fission was studied in bombardments of Th^{232} and U^{238} with 10.5-Mev protons and with helium ions of 29.5 and 42.0 Mev. The number of coincident charged particles per fission observed in the proton bombardment is consistent with the numbers of such particles observed in earlier measurements (spontaneous fission, neutron-induced fission). These results indicate that the production rate of charged particles in fission decreases smoothly with increasing excitation energy of the fissioning compound nucleus. For a nucleus excited to 15 Mev, the rate is about half that for a nucleus in its ground state. The charged particle yields obtained in the helium ion bombardments are, however, much larger than one would expect on the basis of the excitation energy dependence indicated by the other (lower energy) measurements. Some possible explanations for these observations are briefly and qualitatively considered. (auth)

9402 ANGULAR CORRELATION FUNCTIONS FOR COMPOUND INELASTIC NUCLEON SCATTERING. Eric Sheldon (Eidgenossische Technische Hochschule, Zurich). Phys. Rev., 133: B732-56(Feb. 10, 1964).

To aid the analysis of nucleon-γ angular correlation results for target nuclei having zero and nonzero ground-state spins, the double-differential cross section was evaluated in explicit form for compound inelastic scattering of spin-$\frac{1}{2}$ particles to first or to second excited states of nuclei having g.s. spin $0+$, $\frac{1}{2}+$, $1+$, $\frac{3}{2}-$, $\frac{3}{2}-$, $\frac{5}{2}+$, $\frac{7}{2}-$. In several instances, provision was made for the coincident γ radiation to be of mixed multipolarity or for cascades to include an unobserved intermediate γ-decay step preceding the γ transition under observation. Theoretical results are illustrated quantitatively by correlation curves for inelastic neutron scattering at suitable energies around 3 Mev upon appropriate representative target nuclei (Ge^{70}, Zn^{66}, Ni^{64}, Fe^{56}; Si^{29}, P^{31}; P^{32}; S^{35}; Cu^{63}; Zr^{91}; Co^{57}, respectively). (auth)

9403 THEORY OF THE ELECTROMAGNETIC FORM FACTORS OF H^3 AND He^3. L. I. Schiff (Stanford Univ., Calif.). Phys. Rev., 133: B802-12(Feb. 10, 1964).

A theoretical background is provided for recent experiments on the elastic scattering of high-energy electrons from H^3 and He^3. Formulas are derived on the basis of the isotopic spin formalism that relate the observed electric charge and magnetic moment form factors for the two nuclei to the charge and moment form factors of the proton and neutron, two form factors that describe the spatial distribution of the centers of the like pair of nucleons and the odd nucleon (body form factors), and an exchange magnetic moment form factor that is to be determined empirically. The body form factors are then calculated analytically for three assumptions as to the dependence of the wave function on the internucleon distances. Two parameters appear in the calculations with each wave function: a size parameter, and the amplitude of the mixed-symmetry S state that, together with the dominant fully space-symmetric S state, forms the nuclear ground state. The sign of this amplitude predicted on the basis of the known spin-dependent two-nucleon interaction is found to agree with the electron scattering experiments, and its magnitude is reasonable. The available experimental data show a definite preference for the Gaussian and Irving forms of wave function over a modified exponential form, and a slight preference for the Irving over the Gaussian form. The size parameters obtained for these two wave functions are in good agreement with those obtained from the Coulomb energy of He^3, and the probability of the mixed-symmetry S state is found to be about 4%. (auth)

9404 ELASTIC ELECTRON SCATTERING BY SCREENED NUCLEI. Shin-R Lin (Yale Univ., New Haven). Phys. Rev., 133: A965-70(Feb. 17, 1964).

The differential cross section and the asymmetry function of the elastic scattering of electrons from screened nuclei were computed at 10-deg intervals from 10 to 170°. The results of the calculation for gold, with electron energies of 400, 200, 188, 120, 100, and 50 kev; copper, with electron

energies of 400, 200, 100, and 50 kev; and mercury, with electron energy of 204 kev, are reported. The screening potentials used were a three-terms exponential potential for gold, a two-terms exponential potential for copper, and the Hartree potential for mercury. The modified method of the summation of the phase shifts series leads to improved accuracy. The error in the calculated cross section and the asymmetry function is estimated to be not greater than one percent. All results together with the corresponding calculations for Coulomb field are given in tabulated form. (auth)

9405 NUCLEAR ZEEMAN EFFECT IN GOLD ATOMS DISSOLVED IN IRON, COBALT, AND NICKEL. R. W. Grant, Morton Kaplan, D. A. Keller, and D. A. Shirley (Univ. of California, Berkeley). Phys. Rev., 133: A1062-70 (Feb. 17, 1964). (UCRL-10847)

The nuclear Zeeman effect was observed in Au^{197} nuclei dissolved in ferromagnetic hosts, using the Mössbauer effect. The magnetic moment of the 77-kev isomeric state of Au^{197} was measured as $\mu = +0.37$ (4) nm. The hyperfine magnetic fields at Au nuclei dissolved in iron, hexagonal cobalt, cubic cobalt, and nickel were found to be −1420 (180), −980 (120), −990 (120), and −340 (60) kG, respectively, by comparison with external magnetic fields up to 86 kG. Experiments in low external fields gave an unexpected result that is interpreted in terms of magnetostriction in the ferromagnetic sources. (auth)

9406 NUCLEAR DOUBLE IRRADIATION IN SODIUM BROMATE. J. W. Doane and R. A. Hultsch (Univ. of Missouri, Columbia). Phys. Rev., 133: A1085-7(Feb. 17, 1964).

Two different frequency magnetic resonance transitions involving a common energy level are observed simultaneously using the Br^{79} nuclear quadrupole energy levels split by a magnetic field of 7000 G. Irradiation of different transitions with frequencies near 180 Mc may enhance the absorption of a transition near 14 Mc, or produce population inversion enabling observation of a stimulated emission at the lower frequency. The dependence of the enhancement on the r-f voltage of the 180-Mc oscillator is shown. (auth)

9407 SPIN TEMPERATURE IN NUCLEAR DOUBLE RESONANCE. Fred M. Lurie and Charles P. Slichter (Univ. of Illinois, Urbana). Phys. Rev., 133: A1108-23 (Feb. 17, 1964).

A magnetic double resonance technique is described that allows the strong resonance of one nuclear species to be used to detect the much weaker resonance of a second species. Based on the proposal of Hartmann and Hahn, the new technique is experimentally simpler and involves no critical adjustments of experimental parameters. It involves the method of adiabatic demagnetization in the rotating reference frame. The theoretical interpretation is an adaptation of Redfield's thermodynamic approach, performed in a specially chosen reference system. The technique and theory are verified quantitatively in lithium metal using the strong resonance of the 92.6% abundant Li^7 at 15 Mc to detect the much weaker resonance of the 7.4% abundant Li^6 at 5.679 Mc. (auth)

9408 PHOTONEUTRON CROSS SECTIONS OF Tb^{159} AND O^{16}. R. L. Bramblett, J. T. Caldwell, R. R. Harvey, and S. C. Fultz (Univ. of California, Livermore). Phys. Rev., 133: B869-73(Feb. 24, 1964). (UCRL-7156)

The photoneutron cross sections of O^{16} and Tb^{159} were measured up to 30 Mev using photons of 3% resolution resulting from positron annihilation-in-flight. Thirteen resonances corresponding to levels in O^{16} were observed in the $O^{16}(\gamma,n)$ reaction. One, at 29± 1 Mev, is previously unreported. The $O^{16}(\gamma,n)$ cross section integrated to 30 Mev is 46 ± 5 Mev-mb. Both the (γ,n) and $(\gamma,2n)$ cross sections of Tb were measured using a statistical counting technique. The ratio of the two cross sections determines that the level density parameter, $a = 17 \pm 5$ $(Mev)^{-1}$. The sum of the (γ,n) and $(\gamma,2n)$ cross sections is a double peaked giant E1 resonance, from which the intrinsic quadrupole moment was determined to be 7.0 ± 1.1 b. Additional structure in the $Tb^{159}(\gamma,n)$ cross section was observed at 10.1 Mev. The sum of the (γ,n) and $(\gamma,2n)$ cross sections of Tb^{159}, integrated to 28 Mev, is 2.3 ± 0.2 Mev-b. (auth)

9409 DEUTERON STRIPPING REACTION ON Mg^{25}. R. B. Weinberg, G. E. Mitchell, and L. J. Lidofsky (Columbia Univ., New York). Phys. Rev., 133: B884-92(Feb. 24, 1964).

The $Mg^{25}(d,p)Mg^{26}$ reaction was studied at bombarding energies between 3.0 and 5.2 Mev. Angular distributions were measured for proton groups to the ground state and four excited states of Mg^{26}. The elastic scattering in the entrance and exit channels was measured at the appropriate energies and optical-model parameters determined. Using the distorted-wave Born approximation, spectroscopic factors were extracted from the stripping data. Except for the ground state (pure l = 2), a mixture of l values (l = 0 and 2) was required to fit the data. (auth)

9410 NEUTRON TRANSFER TO THE GROUND STATE OF N^{15} IN THE $N^{14}(N^{14},N^{13})N^{15}$ REACTION. F. C. Jobes and J. A. McIntyre (Yale Univ., New Haven). Phys. Rev., 133: B893-907(Feb. 24, 1964).

The neutron transfer differential cross sections were measured at center-of-mass energies of 9, 11, 12, 14, and 16 Mev for the $N^{14}(N^{14},N^{13})N^{15}$ reaction. The energies of the N^{13} nuclei were measured so that the cross sections determined are known to be associated with the transfer of a neutron to the ground state of the residual N^{15} nucleus. It is found that the total cross section for transfer to the ground state of N^{15} is approximately constant over the range of energies studied in contrast to the results of Toth and that a plot of the differential cross section $d\sigma/dR_{min}$ (where R_{min} is the classical distance of closest approach between the nitrogen nuclei) has an exponential dropoff with large R_{min} values that is ⅛ as steep as that given by the semiclassical tunneling theory of Breit and Ebel and at all five energies studied. By considering recent experimental data taken at reaction energies below the Coulomb barrier where the data do agree with a quantum-mechanical formulation of the tunneling theory, it is argued that the large disagreement between the tunneling theory and the higher energy data presented can most likely be accounted for by introducing, as Greider has done, a nuclear interaction between the projectile and target nucleus. (auth)

9411 CROSS SECTIONS FOR THE $Ni^{58}(\alpha,p)$, $Ni^{58}(\alpha,\gamma)$, AND $Co^{59}(\alpha,n)$ REACTIONS. F. K. McGowan, P. H. Stelson, and W. G. Smith (Oak Ridge National Lab., Tenn.). Phys. Rev., 133: B907-11(Feb. 24, 1964).

Thick-target yields were measured for the $Ni^{58}(\alpha,\gamma)$ reaction from 4.9 to 6.1 Mev, the $Ni^{58}(\alpha,p)$ reaction from 4.9 to 11 Mev, and the $Co^{59}(\alpha,n)$ reaction from 5.8 to 10 Mev. The reactions were identified by measuring the coincident annihilation radiation from the induced β^+ activities. The absolute thick-target positron yields, which were measured at approximately 100-kev energy intervals, have an accuracy of ±6%. The reaction cross sections were obtained to an accuracy of 15 to 20% by the differentiation of the smooth thick-target yield curves. Over the measured energy range, the cross sections increase from 1 to 12 μb

for the $Ni^{58}(\alpha,\gamma)$ reaction, 0.6 μb to 316 mb for the $Ni^{58}(\alpha,p)$ reaction, and 0.06 to 228 mb for the $Co^{59}(\alpha,n)$ reaction. The total reaction cross section for Ni^{58} is compared to some values predicted by optical models. The $Co^{59}(\alpha,n)$ yields are compared to those obtained by measuring the neutrons directly with the graphite sphere detector. (auth)

9412 CROSS SECTIONS FOR (α,n) REACTIONS FOR MEDIUM-WEIGHT NUCLEI. P. H. Stelson and F. K. McGowan (Oak Ridge National Lab., Tenn.). Phys. Rev., 133: B911-19(Feb. 24, 1964).

Thick target (α,n) neutron yields were measured from threshold to about 11-Mev α-particle energy for twenty targets ranging in A from 27 to 120. The targets of nickel, copper, and zinc were isotopically enriched. The absolute neutron yields, which were measured at approximately 100-kev energy intervals, have an accuracy of ±4%. The neutron detector was the 4π, flat-energy response graphite sphere detector developed by Macklin. Cross sections for the (α,n) reactions were obtained to an accuracy of ±15% by differentiation of the smooth thick-target yield curves. For those nuclei in which the (α,n) cross section is thought to account for a significant percentage of the total reaction cross section, the observed cross sections are considerably larger than those predicted by Shapiro for his larger radial parameter of 1.5 $A^{1/3}$ F. Both the shape and absolute values of the observed cross sections agree fairly well with the optical-model analysis of reaction cross sections for α particles by Igo. (auth)

9413 ANALYSIS OF $Li^6(Li^6,\alpha)Be^8$ at 3.4 Mev. J. Howard Shafer (Reed Coll., Portland, Ore.). Phys. Rev., 133: B920-5(Feb. 24, 1964).

Angular distributions of alpha particles from $Li^6(Li^6,\alpha)Be^8$ were obtained from five distinct alpha-particle peaks. However, only one peak, that corresponding to the 2.90-Mev state of Be^8, was positively identified. An analysis of the $Li^6 + Li^6$ gamma-ray spectrum with 100 times more counts than previous data indicates that no gamma ray from Be^8 exists with an intensity greater than 2×10^{-3}% that of the 6.90-Mev peak from C^{11} and B^{11}. This indicates an α + d configuration for Li^6. The experiment was performed with a Van de Graaff accelerator. (auth)

9414 ANGULAR DISTRIBUTIONS FOR THE $C^{13}(d,n)N^{14}$ REACTION. Erich H. Willen, P. W. Keaton, and George E. Owen (Johns Hopkins Univ., Baltimore). Phys. Rev., 133: B930-4(Feb. 24, 1964).

Angular distributions of neutrons corresponding to transitions to the ground, first (2.31-Mev), and second (3.94-Mev) excited states were measured at incident deuteron energies between 1.3 and 2.5 Mev. A single stilbene crystal spectrometer utilizing pulse-shape discrimination was employed to separate the ground and first excited states. The second excited-state neutron group was measured with a double crystal time-of-flight spectrometer using the associated gamma ray as a trigger. An analysis in terms of the plane-wave heavy-particle stripping theory was performed to describe the relatively high intensity of neutrons in the backward direction. (auth)

9415 ENERGY DEPENDENCE OF ELASTIC AND INELASTIC SCATTERING FROM C^{12} FOR PROTONS BETWEEN 14 AND 19 Mev. W. W. Daehnick and R. Sherr (Princeton Univ., N. J.). Phys. Rev., 133: B934-48 (Feb. 24, 1964). (PUC-1963-115)

Differential cross sections $\sigma(E,\theta)$ for elastic and inelastic (4.43 Mev) proton scattering by C^{12} were obtained as a continuous function of bombarding energy for 15 scattering angles between 15 and 160°. The energy resolution was approximately 200 kev, and the angular resolution was chosen as $\Delta\theta \leq 2°$. The data show several resonance-like variations for σ(E), <300 to 500 kev wide for all angles observed. Changes in the elastic and inelastic (4.43 Mev) differential cross sections are closely correlated and are strongest near 15 and 17.6 Mev. Use was made of the fact that in a thick target the incident energy is reduced by ionization so that scattering occurs over a range of energies ΔE. Consequently, the energy spectrum of the scattered protons can be used to obtain continuous excitation functions σ(E) over the energy interval ΔE. Polystyrene targets of ΔE = 1.6 Mev were used. A discussion of the thick-target method is presented. Normalizations and cross checks for the thick-target excitation functions were obtained by conventional thin-target cross section measurements. The latter runs also yielded some cross sections for scattering to the 7.66- and 9.64-Mev states in C^{12}. Scattering to the 0^+, 7.66-Mev state showed strong energy dependence while scattering to the 3^-, 9.64-Mev state showed fluctuations of not more than 15%. The scattering cross sections are compared with optical-model calculations and $C^{12}(p,p'\gamma)C^{12}$ γ-yield measurements. (auth)

9416 CHARGE DEPENDENCE OF NUCLEAR FORCES AND THE BREAKUP OF DEUTERONS AND TRITONS. M. Cerineo, K. Ilakovac, I. Šlaus, P. Tomaš, and V. Valković (Inst. "Ruder Bošković," Zagreb). Phys. Rev., 133: B948-55(Feb. 24, 1964).

The proton spectrum at 4.8° from the reaction D(n,p)2n at 14.4 Mev was measured. The high-energy part of that spectrum was analyzed yielding for the neutron-neutron $^1S_0$ scattering length the value: $a_{nn} = -21.7 \pm 1$ F. The correction due to magnetic interaction is 0.8 F and the pure nuclear a_{nn} is therefore $a_{nn} = -22.5 \pm 1$ F. This experimental value is compared with the calculations of Wong and Noyes, and Lin, and indicates that nuclear forces depart by 2 to 3% from the charge symmetry. The charged-particle spectrum at 4.8° from the reaction n + T → n + T, 2n + d, and 3n + p, E_n = 14.4 Mev, was also measured. The effects of the final-state interactions are evident in the spectrum. (auth)

9417 DEUTERON STRIPPING STUDIES IN THE LIGHT ISOTOPES OF NICKEL. R. H. Fulmer (Univ. of Pittsburgh), A. L. McCarthy, B. L. Cohen, and R. Middleton. Phys. Rev., 133: B955-62(Feb. 24, 1964).

Measurements of protons from (d,p) reactions on Ni^{58} and Ni^{60} were made with the Aldermaston tandem Van de Graaff and multigap spectrograph. A large number of states of the final nuclei (over a hundred in each case) were observed and assigned to single-particle states. For the states in the $28 < N \leq 50$ shell, the results for both energies and degree of filling are compared with pairing theory; the agreement is good. A sufficiently large fraction of the l = 2 states is observed to locate the $d_{3/2}$ and $d_{5/2}$ single-particle states at 6.0 and 9.3 Mev, respectively, in Ni^{59}, and at 5.0 and 8.4 Mev, respectively, in Ni^{61}. A relation between neutron-reduced width Γ_n^0 (from neutron experiments) and the stripping spectroscopic factor S is derived and checked experimentally with two levels observed in both experiments; the agreement is satisfactory. Plots of neutron strength function versus energy are obtained containing both neutron and stripping data, and subjected to the requirements of ΣS = 1 and width = 2W (where W is the depth of the imaginary potential in optical model). The results give the location of the $3s_{1/2}$ states as 7.3 Mev in Ni^{59} and 6.0 Mev in Ni^{61}. The distribution of states belonging to each single-particle state is found to have approximately the expected width 2W except for the $g_{9/2}$ state in Ni^{61} which is

concentrated in a single nuclear level. It is shown that the latter behavior is expected since there are no other positive-parity states expected even nearly within a distance W of the single-particle state. In Ni^{59}, the situation is similar except that states are expected and found at a distance ≈1.5W, and these are mixed in weakly. (auth)

9418 SCATTERING OF 18.4-Mev ALPHA PARTICLES BY BERYLLIUM. B. T. Lucas, S. W. Cosper, and O. E. Johnson (Purdue Univ., Lafayette, Ind.). Phys. Rev., 133: B963-75(Feb. 24, 1964).

The differential cross sections for inelastic (1.75-, 2.43-, and 3.04-Mev states) and elastic scattering of 18.4-Mev alpha particles from a self-supporting 176-$\mu g/cm^2$ beryllium foil were measured using silicon surface-barrier detectors. The elastic and inelastic (1.75- and 2.43-Mev states) angular distributions exhibit marked diffraction patterns with regularly spaced maxima that systematically diminish in amplitude with increasing scattering angle. The elastic cross section, after reaching a minimum at about 90°, shows a definite tendency to increase again at back angles reaching 63 mb/sr at 174.4°. In the case of the inelastic scattering to the 2.43-Mev state, this tendency is suggested but not clearly indicated by the present results. The angular distributions associated with scattering to the 1.75- and 3.04-Mev states only extend to about 90°, which precluded any generalization concerning large-angle scattering. An analysis of the angular distributions associated with the ground state and the 2.43-Mev state was made in terms of the Blair diffraction model, assuming that these states are members of the $K = 3/2$ rotational band and that the spin of the 2.43-Mev state is $5/2$. This analysis yielded an interaction radius of 5.7 F and 0.44 for the magnitude of the collective rotational deformation parameter. The angular distributions associated with the 1.8-Mev anomaly and 2.43-Mev state were also analyzed in terms of the direct-interaction theory of Austern, Butler, and McManus. Satisfactory fits were obtained for the 1.8-Mev anomaly with $j_1^2(x)$ and for the 2.43-Mev state with $j_2^2(x)$ using an interaction radius of 5.93 F. Under the assumptions of the applicability of the direct-interaction model and the constancy of the interaction radius, the assignment for the state associated with 1.8-Mev anomaly is argued to be $1/2^+$. Its anomalous shape was fit, assuming a three-particle decay mode $Be^8 + n + \alpha'$, with an S-wave potential-scattering final-state interaction between the neutron and the Be^8 characterized by a scattering length of 30 F. The width of the 3.04-Mev state was measured by fitting various calculated line shapes to the experimental spectrum and was found to be 300 ± 50 kev. (auth)

9419 CORRELATION OF FISSION-FRAGMENT KINETIC-ENERGY FINE STRUCTURE WITH A SEMIEMPIRICAL MASS SURFACE. T. D. Thomas (Princeton Univ., N. J. and Brookhaven National Lab., Upton, N. Y.) and R. Vandenbosch. Phys. Rev., 133: B976-82(Feb. 24, 1964). (PPAD-489-E)

A correlation was established between fine structure in primary fragment yields for thermal-neutron-induced fission of several targets and structure in the energy release calculated from semiempirical mass equations. The origin of the structure in the calculated energy release was elucidated and can be attributed to two general properties of the mass surface: (1) the energy release for even-even products is greater than for odd-mass products, so that the structure is determined by the mass surface for even-even products. (2) The structure for even-even products has a periodicity of about 5 mass units because the mass number of the most stable nuclide for a given Z changes about 2.5 units for a unit change in Z. The existence of structure in the fission fragment yields suggests that there is a preference for forming even-even primary fragments in the fission of an even-even compound nucleus. (auth)

9420 PHOTOPRODUCTION OF NEUTRAL PIONS FROM COMPLEX NUCLEI. C. A. Engelbrecht (California Inst. of Tech., Pasadena). Phys. Rev., 133: B988-1006 (Feb. 24, 1964).

The photoproduction of neutral pions from complex nuclei is expressed in terms of the production amplitudes from single nucleons, as well as certain properties of the nuclear ground state. Methods are developed for the evaluation of the nuclear matrix elements. Correlations between nucleons lead to suppression of the incoherent cross section for small momentum transfers. The coherent nuclear production is strongly peaked at an angle $\theta \approx 2/kR$. Pions can also be produced by the coupling of the incident photon with the nuclear Coulomb field. The cross section for this process is peaked at an angle $\theta \approx m_\pi^2/2k^2$. Final-state interactions of the produced pion are included by means of the Fernbach-Serber-Taylor model. This leads to attenuation of the nuclear production and to a change in shape of the Coulomb production. The theoretical predictions are compared with experimental measurements at 250 and 900 Mev. (auth)

9421 ANALYSIS OF (p,2p) ANGULAR CORRELATION EXPERIMENTS. K. L. Lim (Univ. of Adelaide) and I. E. McCarthy. Phys. Rev., 133: B1006-16(Feb. 24, 1964).

Angular correlations of (p,2p) reactions for various p-shell nuclei are analyzed in the distorted-wave Born approximation with simple shell-model assumptions for the struck particle. The object is to define the limits on the information that can be obtained about nuclear structure from present experiments and to suggest how experiments should be improved. It is found that a simple shell-model wave function for the struck particle can be quite well defined by fitting present experimental data but that the choice of optical-model parameters is highly ambiguous. The ambiguity extends to the determination of the effective two-body potential and the necessity for configuration mixing. The rms radius of the proton distribution obtained from (p,2p) curve fitting agrees well with that obtained from electron scattering. The primary need is for better energy and angular resolution. (auth)

9422 RADIATIVE CORRECTIONS TO HIGH-ENERGY INELASTIC ELECTRON SCATTERING. N. T. Meister and T. A. Griffy (Stanford Univ., Calif.). Phys. Rev., 133: B1032-6(Feb. 24, 1964).

A method for calculating radiative corrections to high-energy inelastic electron-nucleus scattering is presented. The method is applicable to the case where only the scattered electron is detected at a given angle and energy. As an example of this procedure, the radiative corrections to inelastic electron-deuteron scattering are calculated. (auth)

9423 HYPERFINE SPECIFIC HEAT OF URANIUM METAL. C. W. Dempesy, J. E. Gordon, and R. H. Romer (Amherst Coll., Mass. and Brookhaven National Lab., Upton, N. Y.). Phys. Rev. Letters, 11: 547-9(Dec. 15, 1963).

The specific heats of U^{235} and U^{238} metals below 0.75°K were measured. The results show a large T^{-2} contribution to the specific heat of U^{235}, whereas the corresponding term in the U^{238} data is almost negligible. This indicates the presence of a large hyperfine interaction in U^{235}. (auth)

9424 EXPERIMENTAL EVIDENCE FOR J DEPENDENCE OF THE ANGULAR DISTRIBUTIONS FROM (d,p) REACTIONS. L. L. Lee, Jr. and J. P. Schiffer (Argonne National Lab., Ill.). Phys. Rev. Letters, 12: 108-10 (Jan. 27, 1964).

The l = 1 angular distributions were studied for a series of (d,p) reactions at 10 Mev for which the target nucleus had spin 0^+ and the spin of the final state in the product nucleus was $\frac{1}{2}^-$ or $\frac{3}{2}^-$. A distinct difference was observed between the angular distributions for $\frac{1}{2}^-$ and $\frac{3}{2}^-$ final states. Targets of Ca^{40}, Ti^{48}, Fe^{54}, Ni^{58}, Ni^{60}, Ni^{62}, and Ti^{50} were used. (C.E.S.)

9425 μ CAPTURE BY ^{3}He: PARTIAL AND TOTAL RATES. A. F. Yano (Univ. of Rochester, N. Y.). Phys. Rev. Letters, 12: 110-12(Jan. 27, 1964).

The partial and total capture rates are calculated for the reactions $\mu^- + He^3 \rightarrow H^3 + \nu$, $\mu^- + He^3 \rightarrow n + d + \nu$, and $\mu^- + He^3 \rightarrow n + n + p + \nu$. The calculations are based on the Primakoff theory, and the relativistic terms of his effective hamiltonian are included. The wave function used for the He^3–H^3 isotopic doublet is that of Pappademos. (C.E.S.)

9426 ANALYSIS OF THE EXPERIMENTAL EVIDENCE FOR THE EXISTENCE OF A ^{4}H STATE WITH T = 2. Frank von Hippel and P. P. Divakaran (Univ. of Chicago). Phys. Rev. Letters, 12: 128-32(Feb. 3, 1964).

The process $\gamma + He^4 \rightarrow \pi^+ + T + n$, which was previously interpreted in terms of a low-lying resonant state in the n-T system, is discussed. It is concluded that the features observed for this process can be understood without requiring the hypothesis of a resonant state or even of any n-T final-state interaction. It is suggested that this analysis may clarify the background for current searches for a four-nucleon T = 2 state. (C.E.S.)

9427 TIME-DEPENDENT SCATTERING EXPERIMENT. L. R. Dodd (Univ. of Adelaide) and I. E. McCarthy. Phys. Rev. Letters, 12: 136-8(Feb. 3, 1964).

Theory is developed for a time-dependent scattering experiment that consists in following the time development of a photon wave packet scattered resonantly from the metastable state of an appropriate nucleus. (C.E.S.)

9428 ALPHA-PARTICLE MODEL FOR Be^9. Jun Hiura and Ichirō Shimodaya (Hokkaido Univ., Sapporo). Progr. Theoret. Phys. (Kyoto), 30: 585-600(Nov. 1963).

The low-energy properties of Be^9 are investigated on the basis of the α-particle model by making use of α-α and n-α interactions. Variational calculations are made in which the effects of the Pauli principle due to the internal structure of α particles are taken into account. In particular, the inclusion of the dynamics between α particles affects strongly the quadrupole moment, and the predicted value becomes considerably smaller than the value of the usual α-particle model. The ground-state moments μ and Q and low-lying negative parity energy levels are consistently explained by the present model. This means that the α-clusters in Be^9 are well localized and the interaction between inner α-clusters may be not so much different from the free α-α interaction. (auth)

9429 ENERGY GAP IN NUCLEAR MATTER. Takeshi Ishihara (Tokyo Univ. of Education), Ryozo Tamagaki, Hajime Tanaka, and Masaru Yasuno. Progr. Theoret. Phys. (Kyoto), 30: 601-14(Nov. 1963).

The nucleon-nucleon potentials with strong repulsive parts are used, which can reproduce the experimental phase shifts of the high-energy nucleon-nucleon scattering up to 310 Mev. Solving the nonlinear equation for the energy gap directly in the momentum space, the following results are obtained. An energy gap exists in relatively low-density and for rather large effective mass ($0.2f^{-1} \lesssim p_F \lesssim 1.4f^{-1}$ and $0.5m \lesssim m^* \lesssim m$). It does not exist in the very low-density and the high-density and the small effective mass ($p_F \lesssim 0.2f^{-1}$, $p_F \gtrsim 1.4f^{-1}$, and $m^* \leqq 0.5m$). In the normal density ($p_F = 1.42f^{-1}$) there exists no energy gap. Qualitative interpretations of the results are discussed. (auth)

9430 STUDIES OF THE 4.77, 5.11, 5.17 AND 5.58 Mev LEVELS OF B^{10} NUCLEI BY MEANS OF THE $B^9(d,n)B^{10}$ REACTION WITH DEUTERON ENERGIES BETWEEN 2 AND 3 Mev. D. K. Gupta. Thesis, Hamburg, Universität, 1962. 57p. $2.00(Gmelin, AED-DISS 62-548)

Studies of four levels of B^{10} with several deuteron energies indicate that no direct excitation of the 4.77-Mev level is possible. Spin and parities for the other three levels are given. The results confirm predictions by Wilkinson that for small Q values, stripping processes are primary. The dependance of the effective radius on deuteron energy and Q value is in agreement with Wilkinson's results. Measurements of the 5.58-Mev level with a deuteron energy of 2.59 Mev confirm the results of Warburton and Chase. (Gmelin Inst.)

9431 SYSTEMATICS OF β-DECAY ENERGIES. B. S. Dzhelepov and G. F. Dranitsyna. A Pergamon Press Book. Translated by J. B. Sykes from "Sistematika Energii β-Raspada." International Series of Monographs on Nuclear Energy. Division II. Nuclear Physics. Volume 8. New York, The Macmillan Company, 1963. 69p.

Semi-empirical formulae of von Weizsäcker; Bethe and Bacher; Fermi; Cameron; and the empirical formula of Levy for predicting beta-decay energies are discussed. Network diagrams of theoretical decay energies of Cameron and Long are presented. Experimental and theoretical values of total decay energies of various nuclei known up to March 1, 1959 are tabulated. (L.B.S.)

9432 THE LEWIS EFFECT IN GAMMA-RAY RESONANCE YIELD CURVES FROM THICK TARGETS OF ALUMINUM AND NICKEL. Donald Gene Costello. Thesis, Madison, Wis., Univ. of Wisconsin, 1963. 91p.

Al targets evaporated under a variety of conditions all showed a Lewis peak from the thick-target γ-ray yield curve over the $Al^{27}(p,\gamma)Si^{28}$ resonance reaction at 992 kev. The peaks of all targets prepared at pressures below 4×10^{-7} mmHg rose above the plateau to a height of about 10% of the plateau yield. The targets that were prepared at higher pressures showed smaller peaks and were very likely contaminated by material given off by the outgassing of the evaporator unit. Ni targets were prepared using a sublimation process. Thick-target yield curves from the $Ni^{58}(p,\gamma)Cu^{59}$ resonance reaction at 1424 kev showed a Lewis peak. The size of the peak for Ni was considerably larger than for Al. In the case of Ni, the height of the peak above the plateau is about 23% of the plateau yield. Yield curves were calculated for both reactions using a collision spectrum, which takes into account the electron shells of the atom. These calculated curves fit the experimental data much better than previous calculations, which treated the electrons in the target material as free. Because of the very good agreement between the theory and the experimental data from 2 elements widely separated in atomic number, it is felt that the collision spectrum is very close to being correct. Results indicate that previous determinations of the resonance energy of these reactions are in error. The point corresponding to $\frac{1}{2}$ the plateau yield, which has been taken in the past to correspond to the resonance energy, was found to lie about

120 ev below the resonance energy for Al and about 125 ev below for Ni. (Dissertation Abstr.)

9433 THE INELASTIC SCATTERING OF PROTONS BY OXYGEN. Richard Lee Dangle. Thesis, Madison, Wis., Univ. of Wisconsin, 1963. 74p.

The differential cross sections for the inelastic scattering of protons by O^{16} were measured for proton laboratory energies in the range 7.18 to 12.90 Mev. A differentially pumped gas scattering chamber was used in conjunction with a p-n junction solid state detector. Data were taken on the four proton groups corresponding to O^{16} being left in its 1st, 2nd, 3rd, and 4th excited states when such groups were energetic enough to be out of the low energy background. The 2 proton groups, for which the residual nucleus was left in its first or second excited state, were not completely resolved and were decomposed graphically. The 2 proton groups, which left O^{16} in its third or fourth excited state, were always completely resolved and were well separated from the first and second groups. Evidence was found for the existence of 32 levels in F^{17}, the compound nucleus, in the energy range investigated. Approximate resonance energies and laboratory widths were assigned to these levels. Of the levels found in F^{17}, 22 lie below 10.5 Mev. An attempt was made to determine the spins and relative parities of these levels by fitting center of mass angular distributions with Legendre polynomials and noting the complexity of the angular distribution and interference effects. Eight spin assignments and 5 parity assignments were made. (M.P.G.)

9434 A SPHERICAL TENSOR TREATMENT OF GELL-MANN'S "WEAK MAGNETISM" EFFECT IN NUCLEAR BETA-DECAY SPECTRA. James Neal Huffaker. Thesis, Durham, N. C., Duke Univ., 1963. 98p.

Beta-decay spectra for Gamow-Teller allowed and first-forbidden unique selection rules are calculated according to the conserved vector current (CVC) theory of weak interactions. In particular, the spectral effect of the pionic term proposed by Gell-Mann (the Gell-Mann effect) is calculated. Methods of calculation involve the use of spherical tensor operators, Coulomb wave functions for electrons, and a Foldy-Wouthuysen transformation to remove odd nuclear operators. The accuracy of the treatment is such that all second-forbidden corrections to the allowed spectrum, and all third-forbidden corrections to the first-forbidden spectrum, are included. The result for the Gamow-Teller allowed spectrum does not differ much from previously calculated spectra, obtained with both plane waves and Coulomb wave functions. In the case of the first-forbidden unique spectrum, the result for the Gell-Mann effect differs considerably from the previous plane-wave result. The calculated spectra are used to analyse the spectra of B^{12}, N^{12}, N^{16}, and Tl^{204}. (Dissertation Abstr.)

9435 LIFETIMES OF 4+ AND 2+ STATES IN THE ROTATIONAL NUCLEI Dy^{162}, Er^{166}, Er^{168}, AND Hf^{180}. Angela Chi Li. Thesis, New York, New York Univ., 1963. 74p.

Lifetimes of the first 2 excited states (the 2+ and 4+ states) were determined for the even-proton even-neutron nuclei of Dy^{162}, Er^{166}, Er^{168}, and Hf^{180}. These are lifetimes of the order of a 10^{-9} and 10^{-10} sec. The measurements were undertaken to test the predictions of the strong coupling model, according to which these states are classified as members of the ground state rotational band of strongly deformed nuclei. The lifetime measurements were made by the delayed coincidence method. A description is given of this method and of the associated circuitry. Two methods commonly used to analyze delayed coincidence data are the "slope method" and the "centroid shift method." The mathematical description of these methods is given, and the relative merits of the methods are discussed. All the half lives except that of the Hf^{180} 4+ state were determined from the exponential slopes of their respective delayed coincidence time spectra. For the Hf^{180} 4+ state, a centroid shift measurement was necessary because this lifetime is 30% shorter than any of the others. Details of the individual measurements are given and results are presented. From each of the lifetimes, a reduced transition probability B(E2; 1 + 2 → I) is calculated (I being the spin of the state). The ratios B(E2; 4 → 2)/B(E2; 2 → 0) for the 4 nuclei are found to be the following: Dy^{162}, 1.42; Er^{166}, 1.42; Er^{168}, 1.46; and Hf^{180}, 1.45. These are evidently in excellent agreement with the expected ratio of 10/7, and the predictions of the strong coupling model are seen to be verified. (M.P.G.)

9436 THE $O^{16}(p,\alpha)N^{13}$ REACTION. Larry Duane Oppliger. Thesis, Madison, Wis., Univ. of Wisconsin, 1963. 58p.

A differentially pumped gas scattering chamber with a solid state detector was used to measure the differential cross section for the $O^{16}(p,\alpha)N^{13}$ reaction. A detailed excitation curve was taken at $\theta_{LAB} = 166°$ in the energy region $E_p = 7.8$ to 12.9 Mev. The energy steps were 4 to 5 kev and the target thickness ≤3 kev. Excitation curves were also taken at 7 other angles in the energy region E_p = ~7.5 to 10.5 Mev. For these curves the energy steps were 20 kev and the target thickness <3 kev. Smaller energy steps were chosen over narrow resonances. Angular distributions were obtained from these excitation curves at intervals of about 20 kev up to $E_p = 10.5$ Mev. An IBM 704 computer was used to fit these angular distributions with a sum of Legendre polynomials. Analysis of the coefficients of these polynomials as a function of energy gives the spin of levels in the compound nucleus F^{17}. Twenty one levels were found in this region of excitation. The levels with their spin and parity, when they could be determined, are reported. (M.P.G.)

9437 DISTORTED WAVE CALCULATIONS OF (D,P) ANGULAR DISTRIBUTIONS IN STRIPPING REACTIONS. William Robert Smith, III. Thesis, Austin, Tex., Univ. of Texas, 1963. 156p.

Deuteron-stripping differential cross sections based on the distorted-wave Born approximation with diffuse-well nuclear optical potentials were calculated for a large number of reactions at various bombarding energies, using mainly a program whose average running time on a CDC 1604 computer is about 3 sec. Results are presented for the following target nuclei: Be^9, B^{10}, C^{12}, O^{16}, Mg^{24}, Si^{28}, S^{32}, Ca^{48}, Co^{59}, Zn^{68}, Sr^{88}, Zr^{90}, Sn^{116}, Ce^{140}, Pb^{206}, and Pb^{208}. In general, good agreement between theoretical and experimental results was obtained for nuclei with A ≥ 48, using nuclear parameters that are relatively constant for the various reactions and are in accord with the best-fit elastic scattering optical parameters. Thus, for nuclei with A ≥ 48 the distorted-wave Born approximation with diffuse well optical potentials for differential cross sections appears to be satisfactory. On the other hand, for nuclei with A ≤ 32 large variations in the optical parameters were frequently noted for different reactions and bombarding energies, and in some cases all efforts to obtain suitable agreement between theory and experiment failed. The degree and nature of agreement for the light elements appears to depend on the value of the orbital angular momentum quantum number of the captured particle. The effect

of spin-orbit interactions on differential cross sections and on polarizations was also considered for a few selected cases. (Dissertation Abstr.)

9438 VLIYANIE PARNYKH KORRELYATSII SVERKHPROVODYASHCHEGO TIPA NA SVOISTVA ATOMNYKH YADER. (Effects of Superconducting Pairing Correlations on the Properties of Atomic Nuclei). V. G. Solov'ev. Moscow, Gosatomizdat, 1963. 76p.

Mathematical methods developed in superfluidity and superconductivity theory were analyzed. The influence of superconducting pairing correlations on the properties of atomic nuclei was investigated. A new variation principle, nucleon pairing correlations, the superfluid nuclear model, and effects of pairing correlations on α, β, and γ transition probabilities are discussed as well as the properties of the ground and excited states of strongly deformed nuclei. (R.V.J.)

9439 VYKHODY PRODUKTOV DELENIYA I IKH RASPREDELANIE PO MASSAM. SPRAVOCHNIK. (Yields of Fission Products and Their Distribution According to Their Mass. Handbook). Yu. A. Zysin, A. A. Lbov, and L. I. Sel'chenkov. Moscow, Gosatomizdat, 1963. 120p.

Experimental data accumulated from 1939 to 1962 on fission yields and mass distributions are presented. Fission induced by neutrons, γ rays, and 100-Mev charged particles and spontaneous fission are discussed. (R.V.J.)

9440 A UNIFIED NUCLEAR REACTION THEORY FOR PHENOMENOLOGICAL ANALYSES. W. M. MacDonald (Faculte des Sciences, Orsay, France). 22p. (CONF-327-9)

From Topical Conference on Compounds Nuclear States, Gatlinburg, Tenn., Oct. 1963.

A unified nuclear reaction theory is developed in which the direct interaction and the resonant compound nuclear amplitudes are expressed in terms of a model potential and an effective nuclear interaction that can be determined phenomenologically from a shell model calculation of the resonant states defined within the theory. (auth)

9441 THE MÖSSBAUER EFFECT IN IRON-57 (thesis). King Foo Suen (Auburn Univ., Ala.). 61p. (CONF-328-3)

From American Physical Society Southeast Section 1963 Spring Meeting, Knoxville, Tenn., Apr. 1963.

The Mössbauer effect was studied in stainless steel, commercial iron, and pure Fe^{57} at room temperature. The observed result with stainless steel as absorber and Co^{57} impregnated in a stainless steel source was a 34% relative absorption peak of 1.92×10^{-7} ev half maximum width. Commercial one mil iron foil with a content of 95% silicon oriented natural iron gave an internal magnetic field $H_0 = (3.33 \pm 0.01) \times 10^5$ oersteds. The observed Zeeman spectrum of six double peaks differed from those obtained from pure iron since the overlapping of the peaks broadened the half maximum widths. The average separation of the double peaks was 6.24×10^{-9} ev. Using Co^{57}-in-iron source and an iron absorber (six-line source and six-line absorber) a seven-peak spectrum was obtained with the maximum intensity central peak at the point of zero relative velocity. The elliptical polarization of the Fe^{57} 14-kev gamma radiation was observed, using Co^{57} impregnated in iron as a source (six-line source) which was mounted on a permanent magnet, and using stainless steel as absorber, at $\theta = 90$, 45, and 25°, where θ is the angle between the magnetic field and the direction of propagation of the radiation. (auth)

9442 THE $B^{11}(p,\alpha)Be^8$ REACTION FROM 3.5 TO 13 Mev. H. R. Blieden (CERN, Geneva). 15p. (CONF-327-11)

From Topical Conference on Compounds Nuclear States, Gatlinburg, Tenn., Oct. 1963.

Excitation functions at 91.1 and 126.1° for $B^{11}(p,\alpha_0)Be^8$ and at 91.8 and 126.6° for $B^{11}(p,\alpha_1)Be^{8*}$ were measured at 3.5-13 Mev. Twenty-nine angular distributions for α_0 and ten for α_1 were measured in this interval, which corresponds to the region of excitation in the compound nucleus of C^{12} from 19-28 Mev. (C.E.S.)

9443 SCATTERING OF 68-Mev PROTONS BY CARBON. C. H. Poppe, C. F. Hwang, D. H. Nordby, and J. H. Williams (Univ. of Minnesota, Minneapolis). 6p. (CONF-340-7)

From American Physical Society 1963 Autumn Meeting, Chicago, Oct. 1963.

The scattering of 68-Mev protons by carbon-12 was measured at angles of 20 to 115°. The pulse-height spectrum has two prominent peaks corresponding to protons scattered from the ground state and the 4.43-Mev (2^+) excited state of C^{12}. The differential cross section is obtained, and the ratio of the elastic scattering differential cross section to the Rutherford scattering cross section is plotted. (C.E.S.)

9444 GAMMA-GAMMA ANGULAR CORRELATIONS IN THE DECAY OF Sb^{124} (93 sec) AND Sb^{128} (10.8 min). J. Vervier, F. Binon, and P. del Marmol (Centre d'Etude de l'Energie Nucléaire, Mol, Belg.). 5p. (CONF-340-8)

From American Physical Society 1963 Autumn Meeting, Chicago, Oct. 1963.

The decay of Sb^{124} and Sb^{128} to Te^{124} and Te^{128}, respectively, that involve two γ-ray triple cascades was investigated. Angular correlations were measured for these two triple cascades in order to confirm a spin 4 value for the 1.248-kev level in Te^{124} and the 1.508-kev level in Te^{128} and to obtain the spin of the 1.753-kev level in Te^{124} and the 1.828-kev level in Te^{128}. (C.E.S.)

9445 THEORY OF FISSION. Lawrence Wilets (Univ. of Washington, Seattle). 7p. (CONF-346-3)

From International Conference on Nuclear Physics with Reactor Neutrons, Argonne, Ill., Oct. 1963.

The liquid drop model, used to discuss the theory of fission, is reviewed and a successor, the adiabatic model, is discussed. (R.E.U.)

Plasma Physics and Thermonuclear Processes

9446 (63-RL-3254E(Rev.)) FACILITY FOR PRODUCING A SUSTAINED MAGNETIC FIELD IN A THETA PINCH EXPERIMENT. W. F. Westendorp and H. Hurwitz, Jr. (General Electric Co. Research Lab., Schenectady, N. Y.). Nov. 1963. 45p.

The containment of a high-temperature neutron producing plasma can best be studied in a sustained magnetic field. To provide such a plasma by theta pinch compression, a low-frequency magnetic field momentarily suppressed and reversed by a high-frequency pulse is proposed as a means of generation and containment. General principles, circuits, and design criteria are discussed. A specific design is developed in which an available 1600-kjoule capacitor bank is used to establish the low-frequency field and a 384-kjoule bank is used for the high-frequency pulse. Experimental data obtained on model field coils and some measurements on the final coil system are given. (auth)

9447 (63-RL-3307E) A SATURATING REACTOR SWITCH TO EXCITE A HIGH-FREQUENCY TANK CIRCUIT. R. D. Miller (General Electric Co. Research Lab., Schenectady, N. Y.). Apr. 1963. 11p.

A saturating reactor switch was used to transfer 15 joules to a 3.5 Mc/sec, 1.7-ohm tank circuit with a Q of 40, from an external capacitor. An approximate impedance function for the reactor during rapid flux reversal is derived, and the design requirements for the reactor in such a circuit are discussed. The performance of the actual reactor and circuit is described. (auth)

9448 (63-RL-3414E) ELECTRON TEMPERATURE IN A θ-PINCH DETERMINED FROM IMPURITY LINE RADIATION. L. M. Goldman and R. W. Kilb (General Electric Co. Research Lab., Schenectady, N. Y.). Aug. 1963. 18p.

The time variation of the electron temperature during the early compression of a θ-pinch was determined from the times of appearance and peak intensity of lines of C and O in their various stages of ionization. By numerically integrating the rate of ionization equations for specified time variations of electron density and temperature, the transient behavior of various lines can be predicted. The temperature-time dependence is then adjusted until agreement with experiment is obtained. This procedure gives the temperature to within ~50% when it is varying rapidly, and the electron density is known within a factor of two. The results from the C and O data are in agreement. With no initial magnetic field, 0.010 mm D_2, and peak field of 42 kgauss at 6.7 μsec, the time behavior of the electron temperature was found to be 5, 50, 120, and 200 to 300 ev at respectively 0.5, 1.0, 1.5, and 2.0 μsec. These electron temperatures are significantly lower than the best estimates of the deuteron energies at corresponding times. (auth)

9449 (AD-405732) PLASMA PHYSICS AND MAGNETOHYDRODYNAMICS. Merrill F. Aukland, comp. (Defense Documentation Center, Arlington, Va.). June 1963. 169p.

References (800) on magnetohydrodynamics and plasma physics are presented to update the original bibliography (AD 271 170). Abstracts are included with most of the references. (D.C.W.)

9450 (CEA-2364) SOURCE D'IONS INTENSE A FAISCEAU PLAN. (An Intense Plane-Beam Ion Source). R. Dei Cas and F. P. G. Valckx (France. Commissariat à l'Energie Atomique. Centre d'Études Nucléaires, Fontenay-aux-Roses). 1963. 98p.

Experiments performed on a Penning type ion source that is a prototype of the annular ion source intended for the M. M. I. I. device at the Fontenay-aux-Roses Nuclear Research Center are described. It is shown that the existence of a very strong concentration depends in particular on the magnetic geometry. With a suitable magnetic and electrical geometry, it is possible to concentrate the discharge towards the slit and thus to increase considerably the electrical yield and the gas yield. Under pulsed conditions, the current derived from this source can exceed 100 mamp with a slit 20 cm long and 0.2 mm wide. The gas yield can attain 20%. The main characteristics of the discharge and of the beam are examined. (auth)

9451 (CLM-R-32) THE EFFECT OF FINITE ION AND ELECTRON TEMPERATURES ON THE ION CYCLOTRON RESONANCE INSTABILITY. E. G. Harris (United Kingdom Atomic Energy Authority. Research Group. Culham Lab., Culham, Abingdon, Berks, England). Oct. 1963. 14p.

The effect of finite ion and electron temperatures on the ion cyclotron resonance instability is investigated for the Burt-Harris model of a confined plasma cylinder in which the ions move in concentric Larmor orbits with their centers on the axis of the cylinder. By considering changes in particle orbits produced by a self-consistent potential perturbation, a dispersion relation is derived and is studied analytically and numerically. Results are presented graphically for cold electron, cold ions, and equal ion-electron temperatures, showing stability criteria and growth rates. (auth)

9452 (CNAEM-11) CORRELATIONS IN PLASMAS. PART II. CORRELATION FUNCTIONAL REPRESENTATION OF THE BOGOLIUBOV FORMALISM. Kaya Imre and Ercuement Oezizmir (Turkey. Atomic Energy Commission. Cekmece Nuclear Research Center, Istanbul). Dec. 1963. 13p.

The distribution functionals encountered in the Bogoliubov formalism for systems in the kinetic stage are replaced by the correlation functionals in a manner similar to the cluster expansion series. The equation satisfied by these functionals is derived for the case when the interaction potential is binary. It is shown that the analytic solution of this equation subject to Bogoliubov's initial condition is of order λ^{s-1}, where λ is the interaction strength and s is the number of particles involved in the correlation functional under consideration. This property allows breaking of the hierarchy even if the terms of all orders in $n\lambda$, where n is the density, are kept. (auth)

9453 (GA-4843) INVARIANCE OF THE MAGNETIC MOMENT FOR SHORT WAVELENGTH PERTURBATIONS. N. A. Krall and M. N. Rosenbluth (General Dynamics/Fort Worth. Div. of General Dynamics Corp., Fort Worth, Tex.). Jan. 7, 1964. 8p.

Minimum B configurations are magnetic field configurations whose strength increases toward the periphery. It is demonstrated that low-frequency electrostatic instabilities (e.g., universal instabilities) preserve the magnetic moment as an adiabatic invariant and hence are stabilized by the minimum B configurations. (D.L.C.)

9454 (IPPJ-10) RESONANCE PROBE. H. Ikegami and K. Takayama (Nagoya, Japan. Univ. Inst. of Plasma Physics). Mar. 1963. 32p.

Theory for the resonance probe is presented, and experimental procedures and applications are described. Characteristic curves and experimental results are included. (D.C.W.)

9455 (IPPJ-13) MICROWAVE RADIATION FROM A PLASMA IN A MAGNETIC FIELD. Shigetoshi Tanaka, Kenji Mitani, and Hiroshi Kubo (Nagoya, Japan. Univ. Inst. of Plasma Physics). July 1963. 36p.

The microwave radiations from a d-c discharge plasma in a magnetic field were studied. The experimental results showed that the resonant radiations of the extraordinary wave, propagating perpendicular to a magnetic field, were observed not only at $\omega = (\omega_p^2 + \omega_b^2)^{1/2}$, but also near the cyclotron harmonics. On the other hand, it was shown that the dispersion relation for the plasma type oscillations predicted by Bernstein had a harmonic structure. Under the experimental conditions their dispersion curve was divided into many branches, each of which approached asymptotically to the curves given by $\omega^2 = \omega_p^2 + \omega_b^2$ and by $\omega = n\,\omega_b$ (n being an integer). The resonant radiation detected was interpreted as the previously mentioned plasma radiation. The gaps in the radiation spectrum at the cyclotron harmonics were not measured in the discharge plas-

mas. Further, the number of the successive harmonics in a radiation increased with decreasing gas pressure, independently of the kind of gas used. (auth)

9456 (IPPJ-14) THEORETICAL ANALYSIS OF THE CHARACTERISTICS OF RESONANCE PROBE. Yoshi H. Ichikawa (Nagoya, Japan. Univ. Inst. of Plasma Physics). Oct. 1963. 22p.

The theory of the resonance probe was extended to take into account the finite transit time effect of electrons. The theory can predict the over-all frequency dependence of rectified electron current density of the resonance probe that was discovered by Takayama. Furthermore, the various characteristics of the resonance probe observed by Cairns are shown to be consistent with the present theory. (auth)

9457 (NP-13514) THE PRODUCTION OF PULSED MAGNETIC FIELDS FOR PLASMA PHYSICS RESEARCH. Wills Plasma Physics Department Experimental Report No. 1. M. H. Brennan and J. A. Lehane (Sydney. Univ.). Nov. 1962. 18p.

Two sets of pulsed air-cored coils for use in plasma physics research are described. The coils are wound from $^{7}/_{16}$ in. square P de-oxidized Cu, which has a central hole of $^{1}/_{4}$-in. diameter to allow for water cooling. Insulation between turns is provided by glass sleeving and tape, with additional polyester-impregnated cloth between layers. The completed coils are vacuum-impregnated with an epoxy resin to achieve maximum electrical and mechanical strength. Computations on the electronic computer, SILLIAC, were used to devise arrangements of the coils that provide highly uniform fields over the large volumes required. Using one coil type a field of 1 weber m^{-2}, uniform to within 4.5%, was obtained over a cylindrical volume 3 ft long and 6 in. in diameter, despite the presence of several gaps of up to 3 in. along the axis of the cylinder. A second type of coil was used, in conjunction with a bank of electrolytic condensers, to produce a field of 1 weber m^{-2} with similar uniformity over a cylindrical region 5 ft long and $8^{1}/_{2}$ in. in diameter. (auth)

9458 (NP-13515) WILLS PLASMA PHYSICS DEPARTMENT FIFTH SIX-MONTHLY PROGRESS REPORT, JANUARY 1–JUNE 30, 1963. C. N. Watson-Munro (Sydney. Univ. School of Physics). 20p.

The plasma sources SUPPER I and SUPPER II operated satisfactorily, and investigation of $j \times B$ prepared plasmas continued. An electrical analog to the rotating plasma was constructed, and the collision of two contra-rotating plasmas was attempted. The attempt was complicated by an axial current forming at the delayed electrode instead of an immediate $j \times B$ ionizing front. The delayed switch-on of a condenser bank of opposite polarity during the $j \times B$ process did, however, halt the plasma rotation within μsec. Additionally, the observation of a Doppler shift in the H_β light from a rotating plasma indicates that the $j \times B$ process gives rotation to the neutral hydrogen atoms. The radial density variation and temperature of plasmas in SUPPER I were also investigated together with microwave reflection by SUPPER I plasma. The 9 Mc oscillators for ion cyclotron experiments were tested and made operative, and a device for coupling them to SUPPER II was constructed. (D.C.W.)

9459 (NP-13529) THE PRODUCTION OF HYDROGENOUS PLASMAS BY HYDROMAGNETIC IONIZING FRONTS. Wills Plasma Physics Department ER.5. M. H. Brennan, L. C. Robinson, L. E. Sharp, and C. N. Watson-Munro (Sydney. Univ. School of Physics). June 1963. 14p.

The characteristics of hydromagnetic ionizing fronts in hydrogen were investigated over a wide range of pressure, ionizing current, and static magnetic field. The front velocity was found to vary linearly with magnetic field and current and showed a pronounced maximum at a pressure of approximately 20 millitorr. The voltage across the plasma during the ionizing phase was proportional to the static magnetic field and substantially independent of current and pressure. These results are related to other experimental and theoretical investigations. Results are also presented on the spatial distribution and decay rate of the plasma produced by the ionizing front. (auth)

9460 (NP-13530) THE REFLECTION OF MICROWAVES FROM AN ANISOTROPIC PLASMA. Wills Plasma Physics Department ER.6. L. C. Robinson (Sydney. Univ. School of Physics). [1963]. 43p.

The reflection of microwaves from a plasma surface oriented at right angles to the confining magnetic induction field was observed. Interpretation of the observations gave information about the velocity and density structure of the ionization shock front produced during plasma preparation and yielded plasma density decay information. (auth)

9461 (NP-13531) THE DETERMINATION OF PLASMA DENSITY DISTRIBUTION BY A NEW MICROWAVE EXPERIMENTAL METHOD. Wills Plasma Physics Department ER.7. L. C. Robinson (Sydney. Univ. School of Physics). [1963]. 25p.

A method of obtaining the spatial and time resolution of plasma electron density is analyzed and investigated experimentally. The phase shift of a microwave beam reflected from a small modulated dipole within a plasma produces interference effects from which density distribution information is deduced. Possibilities for plasma diagnostic studies based upon these methods are discussed. (auth)

9462 (SC-4938(RR)) A METHOD FOR OBTAINING RADIAL DISTRIBUTIONS FROM OPTICAL MEASUREMENTS ON CYLINDRICAL PLASMAS. W. B. Brooks and G. E. Reis (Sandia Corp., Albuquerque, N. Mex.). Dec. 1963. 19p. Contract [AT(29-1)-789].

A method of inverting Abel's integral equation, which is fairly insensitive to experimental errors, is described. The method approximates the radial distribution by a series of Gaussian distributions; hence the accuracy is best in problems such as gas columns, where Gaussian distributions might be expected. (auth)

9463 (SSD-TDR-63-261) SURFACE IMPEDANCE OF A THIN PLASMA SHEET. T. M. Smith and K. E. Golden (Aerospace Corp., El Segundo, Calif.). Oct. 7, 1963. Contract AF04(695)-269. 61p. (AD-425654)

An analysis is made of electromagnetic propagation through a homogeneous, isotropic, and slightly ionized plasma slab. Exact solutions for the reflection and transmission coefficients are given as functions of slab thickness, incident angle, and plasma wave number. Two approximations that allow the plasma slab to become a thin current sheet are introduced. When the approximations are valid, the reflection and transmission coefficients for the thin plasma are a function of the sheet surface impedance only. This surface impedance is related simply to the product of the sheet thickness and conductivity. (auth)

9464 (TID-18047) STUDIES OF PLASMA OSCILLATIONS. Quarterly Status Report No. 12, September 1–November 30, 1962. (Stanford Univ., Calif. Microwave Lab.). Jan. 1963. Contract AT(04-3)-326. 34p. (ML-999)

Solutions were derived by a variational method for dipole resonant frequencies in plane and spherical plasma geometries. Theory for probe characteristics in the presence of noise was also developed and experimentally verified. Experimental work on the radiation waves propcsed to explain the peaks in low-frequency noise spectra involved light intensity profile measurements on cylindrical and rectangular tubes. Research on striations in mercury-vapor discharges and on double sheaths at tube constrictions continued, and theoretical work on plasma impedance at frequencies of zero to a few Mc/sec was supplemented by measurements in a tube containing a movable anode. (D.C.W.)

9465 (TID-19928) A STUDY OF THE NEIDIGH ARC. Final Report, June 10, 1960 to September 30, 1963. William B. Pardo (Miami, Fla. Univ., Coral Gables). Contract AT(40-1)-2762. 139p.

The conditions under which the sharp transition in the properties of the arc plasma occurs were investigated. The validity of Simon's model for the transition was also examined. Some of the transitions observed had the magnetic field-pressure dependence required by the model. Additionally, resonance diffusion of plasma across the magnetic field was apparently observed, and attempts were made to measure the characteristics of the arc plasma in Mode II with velocity analyzers. (D.C.W.)

9466 (TID-19928([Sect.2])) THE APPLICABILITY OF THE CROSSED FIELD VELOCITY ANALYZER IN PLASMA DIAGNOSTICS (thesis). David Orvis Stringfellow (Miami, Fla. Univ., Coral Gables). 61p.

It is shown that the collector current as a function of plate voltage can be calculated for an analyzer in a plasma in which the velocity distributions of both the electrons and the ions are known. The conditions that must be met if the analyzer is to perform properly were also established. The results indicate that the analyzer is not a generally useful diagnostic tool. (D.C.W.)

9467 (TID-19961) NOTIONS GENERALES SUR LA THEORIE MACROSCOPIQUE DES ONDES DANS LES PLASMAS. (General Notions on Macroscopic Theory of Waves in Plasmas). W. P. Allis (Massachusetts Inst. of Tech., Cambridge); and J. L. Delcroix (Paris. Université, Orsay. Ecole Normale Superiéure. Faculté des Sciences). [1963]. Contract AT(30-1)-1842. 42p.

The propagation of monochromatic plane waves in an indefinite plasma is treated in the hydrodynamic theory of two fluids. Plasmas with isotropic pressure and waves obeying exact adiabaticity are considered. (D.C.W.)

9468 (TID-19974) STUDIES OF PLASMA OSCILLATIONS. Quarterly Status Report No. 15, June 1–August 31, 1963. (Stanford Univ., Calif. Microwave Lab.). Oct. 1963. Contract AT(04-3)-326. 28p. (ML-1101)

The frequencies of the resonances observed in the previous dipole resonance studies were predicted in closer agreement with experimental data. Theory for plasma production in which ionization is produced by an electron beam either partially or completely filling the tube section was also developed. Preliminary experimental results are consistent with the beam-plasma interaction theory. Additionally, ion waves excited on the positive column of a low-pressure Hg discharge by a magnetic field coil were studied. On the anode side of the coil, heavily damped waves were observed to propagate at frequencies of 2 to 40 kc/sec. The wavelengths were long (40 to 80 cm), and the phase velocities were higher than the ionic sound speed. No propagation was observed on the cathode side of the coil. A simple theory taking account of damping apparently can give an approximate explanation of the experimental results. Refined apparatus for studying the double sheath that forms at a discharge tube constriction was constructed. (D.C.W.)

9469 (TID-20009) AN EXPERIMENTAL INVESTIGATION OF AN ELECTRON INSTABILITY IN A CYLINDRICAL TROCHOTRON (thesis). Walter Lee Powers (Tennessee. Univ., Knoxville). Dec. 1963. Contract AT(40-1)-2598. 64p.

Instability in an electron tube with crossed electric and magnetic fields, such that the electrons have trochoidal paths, were studied. Parasitic instabilities were observed long before the critical current required for instability on the basis of Harris' theory was reached. The observations were also compared with other experimental results. (D.C.W.)

9470 (TID-20033) INVESTIGATIONS OF THE HYBRID ION-ELECTRON RESONANCE. Semi-Annual Status Report No. 1, June 1–November 30, 1963. (Texas. Univ., Austin). Contract AT(40-1)-3110. 26p.

Theory for the appearance and properties of hybrid resonances in electromagnetic wave propagation perpendicular to the direction of a static magnetic field in a plasma is presented. The apparatus being constructed to investigate the resonances is described, and preliminary experiments are summarized. (D.C.W.)

9471 (UCRL-10990) A STUDY OF HYDROMAGNETIC WAVE PROPAGATION IN PLASMA (thesis). George R. Spillman (California. Univ., Berkeley. Lawrence Radiation Lab.). Oct. 2, 1963. Contract W-7405-eng-48. 95p.

The excitation of torsional and compressional hydromagnetic waves and the dispersion relation of the torsional wave in a cylindrical deuterium plasma were investigated. The theory of azimuthally symmetric waves in a cylinder is reviewed, and an expression is derived for the relative excitation of the two wave types by a current between concentric electrodes. The wave type propagating in the cylinder at various frequencies was established by simultaneous measurements of the r and θ components of the wave magnetic field, and the dispersion relation of the torsional wave was measured in the frequency range 0.04 to 0.48 times ion-cyclotron frequency. (The upper frequency limit is due to domination of the compressional wave at higher frequencies.) The measured wave velocity agrees with theoretical calculations of the velocity based on the average of the spectroscopically measured ion density. Scatter in attenuation measurements is too large to give good agreement with the theoretical attenuation, however, the proper general trend is observed. Observations of a plasma surface wave are included. (auth)

9472 (VIDYA-101) TRANSPORT AND CORRELATION IN A HIGHLY IONIZED GAS. Period Covered: August 1, 1962 to July 31, 1963. M. Rudin (Vidya. Div. of Itek Corp., Palo Alto, Calif.). Aug. 30, 1963. Contract Nonr 3581(00). 105p.

The computation of two-particle correlation functions and transport properties for an inhomogeneous ionized gas is considered with a dressed-particle approach. It is demonstrated that the dressed-particle model–where particles, dressed by the charge cloud they induce, collide without distortion of the clouds, and these collisions themselves generate the clouds–can be rigorously formulated with distribution functions. Use of this dressed-particle approximation in the Born-Green-Bogoliubov-Yvon-Kirkwood Chain of equations makes it necessary to consider only the one-body and two-body equations. A procedure for obtaining perturbed thermodynamic equilibrium

solutions to these equations is described for an inhomogeneous plasma. From these solutions, transport properties follow immediately. The divergence, in classical physics, of the two-particle correlation function for very small inter-particle distances is overcome by introducing quantum statistics to the extent of a Fermi-Dirac distribution for the electrons. For thermodynamic equilibrium, this problem is then equivalent to making the dressed-particle approximation in Poisson's equation and using Fermi-Dirac statistics. It is shown how a solution to this latter problem (obtained by iteration) would yield an effective ionization potential for particles in a plasma in a more direct manner than heretofore obtained. It is believed the dressed-particle model used provides a more reliable and more convenient singly self-consistent method of including both short-range and long-range particle collision effects when computing transport properties in a plasma. (auth)

9473 ON THE RECENT STUDIES OF THE FINITE AMPLITUDE WAVES IN THE COLLISION FREE PLASMA UNDER THE INFLUENCE OF THE MAGNETIC FIELD. Takeo Sakurai (Kyoto Univ.). Bull. Aeronaut. Res. Inst., Univ. Tokyo, 3: (Special Issue) A39-48(Sept. 1963). (In Japanese)

A survey of recent studies of the finite amplitude waves in the collision-free plasma under the influence of the magnetic field is given. The basic equations for the flow of the collision-free plasma in the magnetic field (Boltzmann's equations for both the ions and the electrons and Maxwell's equations) are given, and the difficulty in handling these equations is explained. The basic equations for the especially simple case of the collision-free cold plasma are derived. As a typical example of the finite amplitude waves in the collision-free cold plasma, the solitary waves propagating perpendicularly to the magnetic field are discussed in detail. As the other typical example of the finite amplitude waves in the collision-free (but not cold) plasma, shock waves induced by the sudden application of the electric field and propagating perpendicularly to the magnetic field into a plasma at rest are discussed in detail. Other related studies are also discussed briefly. (auth)

9474 EXPERIMENTS ON THE HIGH TEMPERATURE PLASMA IN THE HELIOTRON B. Akihiro Mohri and Riso Kato (Kyoto Univ.). Bull. Aeronaut. Res. Inst., Univ. Tokyo, 3: (Special Issue) A84-90(Sept. 1963). (In Japanese)

The Heliotron magnetic field is produced by an electric current in a series of pair coils wound around the discharge tube at regular intervals. The electric currents in the pair coils have opposite directions and different intensities. The lines of force near the tube axis undulate without crossing the wall, while those near the tube wall cross the wall. Thus a high-temperature plasma produced by ohmic heating is expected to be confined in the central region of the field. Experiments were carried out in order to verify the spatial confinement of a plasma in this field. The plasma current was observed only within the central region whose diameter was about 3 cm, and the plasma had a sharp boundary. Outside the region there was no current. These results suggest that the hot plasma is kept apart from the wall of the discharge tube in the Heliotron magnetic field. (auth)

9475 THERMODYNAMIC CALCULATIONS FOR PLASMA (HIGH-TEMPERATURE GASES). K. K. Neumann and K. R. Knoche (Technische Hochschule, Braunschweig, Ger. and Technische Hochschule, Stuttgart). Chem.-Ingr.-Tech., 35: 631-7(Sept. 1963). (In German)

Some graphs relating to argon and carbon compounds are presented as typical examples of a large number of calculated equilibrium compositions and thermodynamic values for high-temperature plasmas. The basis for the system of formulation used is explained, and flow diagrams are given for computer calculations. (auth)

9476 ON THE STATE OF IONIZATION IN WEAKLY IONIZED PLASMA IN THE NON-EQUILIBRIUM STATE. Kenya Matsuura. Denki Shikensho Iho, 27: 491-5(July 1963).

A generalized Saha equation for the steady state of ionization in a nonequilibrium plasma is derived by means of the technique of quantum statistical perturbation theory and is applied to a model of a system in which the electrons are in the thermal equilibrium state at the temperature T_e and the ions and neutral atoms at the temperature T_a. The generalized Saha equation for this model is obtained as $(n_i n_e/n_a) = [2(2\pi mkT_e)^{3/2}/h^3](T_e/T_a)^{3/2} e^{-(V_i/kT_e)}$ assuming that the ions and neutral atoms are at rest. (auth)

9477 TRANSVERSE INJECTION OF PLASMA CLUSTERS. G. Ya. Umarov (Inst. of Physics and Tech., Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 2, 56-60(1963). (In Russian)

Transverse injection of several clusters into adiabatic traps results in cluster capture and formation of convolutions that attenuate oscillations, the convolution energy transforming into Joule heat. The plasma is confined following convolution decay. (R.V.J.)

9478 A MEANS OF DETERMINING PLASMA DENSITY DISTRIBUTION. L. C. Robinson (Univ. of Sydney). J. Appl. Phys., 35: 458-9(Feb. 1964).

A method for determining electron density distributions in a plasma that is based on microwave reflections from a modulated dipole in the plasma is proposed, and results of initial tests using transient plasmas are given. (C.E.S.)

9479 HIGH-FREQUENCY OSCILLATIONS IN A THERMAL PLASMA. William H. Cutler (Stanford Univ., Calif.). J. Appl. Phys., 35: 464-5(Feb. 1964).

High-frequency oscillations were observed in a thermal cesium plasma in a diode. The high-frequency bursts occur in conjunction with low-frequency fluctuations. The low- and high-frequency oscillations are listed as a function of diode spacing. (C.E.S.)

9480 HIGHER ORDER ANALYSIS OF NON-LINEAR PLASMA OSCILLATIONS. Louis Gold (Kennecott Copper Corp., Lexington, Mass.). J. Electron. Control (1), 15: 531-5(Dec. 1963).

An investigation of nonlinear oscillations in a cold plasma in terms of the fluctuating charge density discloses the existence of a charge gradient term, which leads to a somewhat modified behavior. An altered second-order differential equation is encountered whose integration to a first-order equation (which is none the less intractable) permits establishment of the occurrence of nonlinear periodic motion of the charge. (auth)

9481 AN ANALOGUE COMPUTER STUDY OF THE COLLAPSE STAGE OF THE LINEAR Z-PINCH. R. J. Churchill and D. F. Gallaher (Univ. of British Columbia, Vancouver). J. Electron. Control (1), 15: 633-40(Dec. 1963).

A special-purpose analog computer, that solves the so-called snow-plough equation describing the initial collapse stage of the linear Z-pinch discharge, is described. Collapse curves, generated by the computer for a low energy (5.4 kJ) Z-pinch in argon and nitrogen, are presented. These compare favorably with digital-computer calculations and with photographic measurements of the discharge development. (auth)

9482 THE PROPAGATION OF ELECTROMAGNETIC WAVES IN A MEDIUM PENETRATED BY A PLASMA STREAM. E. Raeuchle (Technische Hochschule, Stuttgart). J. Nucl. Energy, Pt. C, 5: 329-34(Nov.-Dec. 1963). (In German)

A formal discussion of the propagation of electromagnetic waves in a medium penetrated by a plasma stream is presented. The dispersion relations are established similarly as was done by Getmantsev. This formal treatment of this problem is developed in such a manner as to avoid the otherwise necessary solution of the equations of motion for the particles. Instead of giving approximate solutions for the implicit dispersion relations, exact solutions are obtained by splitting the dispersion relations into appropriate factors. There result three types of waves, proper electromagnetic waves showing no drag effect in a first approximation, Cherenkov waves, and waves with complex index of refraction. (auth)

9483 EXCITATION OF MAGNETOACOUSTIC WAVES IN A PLASMA. H. U. Hostettler and H. Schneider (Universität, Freiburg i. B.). J. Nucl. Energy, Pt. C, 5: 335-40 (Nov.-Dec. 1963). (In German)

Longitudinal hydromagnetic (magnetoacoustic) waves can be excited in an argon plasma, which is generated and heated by a critically damped discharge of a condenser bank parallel to an external, pulsed magnetic field. Two probes reaching into the plasma from opposite sides contain the emitter and receiver coil, respectively. In order to excite the waves, a small and fast capacitor is discharged through the emitter coil about 70 μsec after the heating current has dropped to zero, when the plasma is in a quiescent state in thermal equilibrium. Phase velocities and damping coefficients for different magnetic field strengths and different plasma densities were measured. The theory of plasma waves was extended and applied to the particular plasma conditions of the experiments. The theory fits the experimental data remarkably well. From the measured phase velocities for vanishing magnetic field strength the plasma temperature can be found and the phase velocities at higher magnetic field strengths allow to determine the degree of ionization. In the experiments temperatures of 14,000°K and about 16 per cent ionization were found. (auth)

9484 A SIMPLE HYDROMAGNETIC STABILITY PROBLEM INVOLVING FINITE CONDUCTIVITY, ELECTRON INERTIA AND THE HALL EFFECT. R. J. Tayler (Cambridge Univ., Eng. and United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). J. Nucl. Energy, Pt. C, 5: 345-53(Nov.-Dec. 1963). (CLM-R-26)

A study is made of the hydromagnetic stability of a current-carrying fluid whose Ohm's law includes finite conductivity, electron inertia, and the Hall effect. The system was previously shown to be unstable when finite conductivity alone is considered. It is found that the system is still unstable. The introduction of the Hall effect does lead to a reduction in growth rate but electron inertia is a further destabilizing influence. In none of the cases studied is the growth rate reduced by an order of magnitude. It is possible that viscosity (which was not included) causes a larger reduction in growth rate than the Hall effect. (auth)

9485 THE STABILITY OF TWISTED MAGNETIC FIELDS IN A FLUID OF FINITE ELECTRICAL CONDUCTIVITY. II. THE HARD-CORE PINCH OF LOW CONDUCTIVITY. R. J. Tayler (Cambridge Univ., Eng. and United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.), and F. R. A. Hopgood. J. Nucl. Energy, Pt. C, 5: 355-61(Nov.-Dec. 1963).

The stability of the hard-core pinch of low conductivity is investigated. A variety of magnetic field configurations is studied in some of which the axial magnetic field reverses its direction inside the plasma column. Perturbation growth rates are obtained for m = 0 and m = 1 perturbations. It is shown that the introduction of low conductivity leads to instability in all cases studied but that systems with reversed axial fields are less unstable than those without field reversal. The possible validity of these results is discussed. (auth)

9486 A NUMERICAL EXPERIMENT ON θ-PINCH IONIZATION. K. V. Roberts (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). J. Nucl. Energy, Pt. C, 5: 365-9(Nov.-Dec. 1963).

A numerical experiment is reported for a preheat discharge in a θ-pinch geometry. This type of discharge is intended to represent one stage in the operation of a multistage θ-pinch experiment that might comprise weak r-f preionization, a low-power Z-pinch to bring the ionization to 5%, a preheat stage to complete the ionization, followed by firing of the main bank. (C.E.S.)

9487 SYMMETRIZATION OF THE MODEL C STELLARATOR. D. J. Grove, W. L. Harries, R. M. Sinclair, and S. Yoshikawa (Princeton Univ., N. J.). J. Nucl. Energy, Pt. C, 5: 368-9(Nov.-Dec. 1963). (MATT-192)

The model C stellarator is symmetrized by applying a magnetic field B_T transverse to the confining field B_0 so as to close the flux lines of B_0. The measurements of various plasma parameters in the stellarator as functions of B_T were used to calculate B_S (the particular value of B_T required for symmetry) and thus predict the lack of closure of the confining field. It is demonstrated that a deliberate change in this lack of closure will produce a desired change in B_S. (C.E.S.)

9488 ANOMALOUS MICROWAVE RADIATION AT CYCLOTRON RESONANCE IN PARTIALLY IONIZED PLASMAS. Shigetoshi Tanaka (Kyoto Univ.), Yasushi Termuichi, Kenji Mitani, and Hiroshi Kubo. J. Phys. Soc. Japan, 18: 1810-21(Dec. 1963).

An anomalous microwave radiation from a d-c discharge plasma in a magnetic field was observed. The intensity was extremely large compared with that of black body (about 1×10^{4}°K) and amounted to the power radiated from the plasma in the thermal equilibrium equivalent to 5.5×10^{6}°K in the case of Kr and 1.5×10^{6}°K in the case of Xe. This radiation occurred very sharply at cyclotron resonance field, the width being by one order smaller than that of normal cyclotron radiation. The radiation was observed in Xe, Kr, and Ar plasmas in the pressure range of 0.1 to 5 mm Hg, but not in Ne and He plasmas at any pressure. Further, the radiation was observed when the whole tube was placed in a longitudinal magnetic field, but not when only a part of the positive column was immersed in the field. It is discussed whether this anomalous radiation can be interpreted as a phenomenon of the negative radiation temperature at cyclotron resonance in partially ionized plasmas. (auth)

9489 OSCILLATIONS IN PLASMA III (DIPOLE MODE). Shoji Kojima, Kiyoe Kato, and Satoru Kiyama (Tokyo Univ. of Education). J. Phys. Soc. Japan, 18: 1826-9(Dec. 1963).

In a hot cathode discharge tube, dipole oscillations having the frequency of $f_p/\sqrt{2}$ were observed without applying external oscillating electric fields, where f_p is the frequency of the plasma electron oscillation. In the presence

of a weak magnetic field the dipole oscillation split into two oscillations whose frequencies were given by

$$f_\pm = \sqrt{[f_p^2/2 + (f_c/2)^2]} \pm f_c/2,$$

where f_c is the cyclotron frequency of electron. (auth)

9490 OBSERVATION OF THE ION RESONANCE BY A rf PROBE. Kiyoe Kato, Kiyoshi Ogawa, Morihiro Yoseli, and Hiroko Shimahara (Electrotechnical Lab., Tokyo). J. Phys. Soc. Japan, 18: 1849-50(Dec. 1963).

An ion resonance that shows a steep maximum in the probe d-c current at the plasma-ion frequency $f_i = (ne^2/\pi M)^{1/2}$ is reported. The apparatus for its observation is described. (R.E.U.)

9491 RADIATION LOSSES FROM HIGH-TEMPERATURE GAS DISCHARGES. A. C. Kolb (Naval Research Lab., Washington, D. C.). J. Quant. Spectry. Radiative Transfer, 3: 365-75(Oct.-Dec. 1963).

An account is given on some numerical calculations of the impurity-radiation losses and cooling of a deuterium plasma produced by high-current electrodeless discharges in low-inductance, single turn coils (θ pinches). A semi-quantitative comparison of the theory was made with available experimental data. In general, the observed gross features of θ pinch discharges can be described by the hydromagnetic theory, including Corona-like radiation effects. (P.C.H.)

9492 RESPONSE OF A PARTIALLY IONIZED DRIFTING PLASMA TO TEMPERATURE PERTURBATION. Takayoshi Okuda, and Kenzo Yamamoto (Nagoya Univ., Japan). Kakuyugo-Kenkyu, 11: 146-78(Aug. 1963).

Impedance formulas for partially ionized plasma are derived on the basis of the transport equation involving temperature perturbation. In the first attempt, the density perturbation is completely neglected but the inertia term is retained. The second is based on the ignorance of all space derivatives of the density, velocity, and temperature. In the third attempt, use is made of the quasisteady approximation, but without exception of the term related to the space charge field. (auth)

9493 A MODEL OF ANOMALOUS RELAXATION OF ELECTRONS IN DISTURBED PLASMAS. Noboru Hokkyo (Hitachi Ltd., Tokyo). Kakuyugo-Kenkyu, 11: 222-7(Aug. 1963). (In Japanese)

A new mechanism is suggested for the anomalous relaxation of electrons in a disturbed plasma in which the velocity distribution function of electrons fluctuates around some smooth function. The analysis of the Nyguist diagram, which is a plot as a function of ω/k of real and imaginary parts of $w = (\omega_p^2/k^2)\,\epsilon(k,\omega)$, where $\epsilon(k,\omega)$ is the dielectric constant, shows that as we go to smaller k values the diagram crosses the origin of the complex w-plane (zeros of $\epsilon(k,\omega)$ at a number of points), each crossing giving a possible value of ω/k and hence the dispersion relation for a possible wave mode in the medium. That these modes have acoustic type dispersion relations is easily seen by the observation of the diagram. The energy loss of a fast electron incident on the disturbed plasma will be greatly increased due to excitation of these extra modes arising from the fluctuation, in addition to the usual loss associated with plasmon excitation. The fluctuation in the velocity distribution function may be due either to external causes or to runaway electrons on some other cooperative phenomena in the medium. (auth)

9494 ON THE PLASMA CONFINEMENT WITH TRAVELLING MAGNETIC FIELD. Hiromichi Kondo and Katsushi Toshioka (Mitsubishi Electric Corp., Japan). Kakuyugo-Kenkyu, 11: 344-70(Oct. 1963).

The method of plasma confinement with travelling magnetic fields was investigated both from magnetohydrodynamic and from charged-particle orbit theory. The eminent advantages of applying travelling magnetic fields to plasma confinement is thought to consist in its highly gradiented field configuration to provide a completely stable magnetic bottle and in its restoring action to drive a particle back to the plasma region. Two facts are pointed out: one is the need for superposition of two oppositely travelling fields, and the other is that the gradiented travelling field has the effects of driving the charged particles toward the direction in which the field strength decreases and thus eliminates the particle losses from the plasma region. These facts suggest the possible realization of stable confinement of thermonuclear plasma. The need of superposing static magnetic induction on this scheme is also discussed. (auth)

9495 SECOND ORDER PERTURBATION THEORY OF RESONANCE PROBE. Takashige Tsukishima (Nagoya Univ., Japan). Kakuyugo-Kenkyu, 11: 371-87(Oct. 1963). (In Japanese)

The increment of the direct current in the resonance probe is calculated from the second order perturbation term of the electron distribution function, when it is expanded in powers of a small amplitude of the a-c voltage applied to the probe. The increment δ_j thus calculated well explains previous experimental results, that is, δ_j retains a finite value for $\omega_\theta < \omega_p$, shows a resonant peak at $\omega_\theta = \omega_p$, and goes down to zero for $\omega_\theta > \omega_p$, where ω_θ and ω_p are the applied frequency and plasma frequency respectively. The calculation also shows that the ratio of the peak height to the value of δ_j at $\omega_\theta = \omega$ is independent of the d-c probe potential and given by $\{(\omega^2 + \nu^2)/(\omega_p^2 + \nu^2)\}|\epsilon(\omega)/\epsilon(\omega_p)|^2$, the half width being give by 2ν, where ν is the effective collision frequency of the electron with neutral molecules and $\epsilon(\omega)$ is the complex dielectric permittivity of plasma. (auth)

9496 A NEW METHOD OF PLASMA CONFINEMENT WITH TRAVELLING MAGNETIC FIELDS. Hiromichi Kondo and Katsushi Toshioka (Mitsubishi Electric Corp., Japan). Mitsubishi Denki Giho, 37: 1142-8(Sept. 1963). (In Japanese)

A new method is proposed for plasma confinement in a cylindrical shape. The rotating field produced by the axial currents is given by $i_z = I \sin(\omega t + m\theta)$ and $m = 3,4,5\cdots$ in the region $b < r < e$, where γ, θ and z indicate the cylindrical coordinates. The plasma column to be confined is approximated by a solid cylinder of metal (radius a) with the electromagnetic constants σ and μ_0. A numerical example shows that approximately 100 atm pressure can be realized in a cylinder of 3.2 m diameter with $I = 2.1 \times 10^7$ A/m^2 in the region $\gamma > 4$m. It is expected that perfectly stable and continual confinement of plasma can be obtained. (auth)

9497 OBSERVATIONS OF THE ZETA SPECTRUM IN THE WAVE-LENGTH RANGE 16 Å–400 Å. B. C. Fawcett, A. H. Gabriel, W. G. Griffin, B. B. Jones, and R. Wilson (United Kingdom Atomic Energy Authority, Abingdon, Berks, Eng.). Nature, 200: 1303-4(Dec. 28, 1963).

Results of observations of the Zeta spectrum in the wavelength range 16–400 Å are reported. The instruments used for the observations are described. The region 16–50 Å contains the important resonance lines of the common impurity elements carbon, nitrogen, and oxygen in their helium-like and hydrogen-like ionic species. Above 50 Å the spectral lines are generally formed by more complex systems but identifications are proceeding. An important exception occurs in the wavelength range 170–212 Å. A

very intense system of lines occurs in this region, the wavelengths of which do not coincide with any known lines. (P.C.H.)

9498 CONNECTION BETWEEN SHIELDING AND STABILITY IN A COLLISIONLESS PLASMA. F. Engelmann (EURATOM-CNEN, Frascati, Italy), M. Feix, and E. Minardi. Nuovo Cimento (10), 30: 830-6(Nov. 1, 1963).

The penetration of an externally applied electric field into a collisionless plasma in a box is generally studied by means of Vlasov's equation in the stationary case. The following property is shown to hold in the linear as well as in the nonlinear domain provided that the plasma is not too inhomogeneous: if the plasma is electrostatically stable it shields an external electric field, and a plasma showing no such shielding is microinstable. Nevertheless shielded situations can also appear for microinstable plasmas. In particular, the plasma is always instable when a maximum of the modulus of the electric field exists within the box. (auth)

9499 LONGITUDINAL OSCILLATIONS IN PLASMA. V. Šips (Institute "Rudjer Boskovic," Zagreb). Nuovo Cimento (10), 30: 947-57(Nov. 1, 1963).

By applying the method of the equation of motion to density fluctuations and using the random phase approximation, the dispersion relation for a N-component plasma is found. In the case of N = 2 the dispersion relation derived by Nakajima is obtained. Application is made to a three-component classical plasma and the corresponding frequencies are determined. (auth)

9500 ON NON-LANDAU DAMPED SOLUTIONS TO THE LINEARIZED VLASOV EQUATION. J. N. Hayes (Naval Research Lab., Washington, D. C.). Nuovo Cimento (10), 30: 1048-63(Nov. 16, 1963).

Because of the existence of perturbations on the equilibrium velocity distribution of an electron plasma that are entire functions and yet do not give the damping predicted by Landau, the Landau calculation is re-examined critically for the source of these solutions. It is shown that certain tacit assumptions go into the Landau calculation that were not proved there, but are demonstrated to be true. A broad class of initial perturbations is constructed that satisfies all the Landau criteria but does not yield Landau damping. These results derived for a Maxwell equilibrium distribution are generalized to a broader class of equilibrium distributions. Newcomb's result that an increasing electric potential cannot be monotonic is quite simply proved as a by-product of the integral equation for the plasma. (auth)

9501 SCATTERING OF PLANE PLASMA WAVES FROM A PLASMA SPHERE. Asim Yildiz (Raytheon Co., Wayland, Mass.). Nuovo Cimento (10), 30: 1182-1207 (Dec. 1, 1963).

The scattering of plane longitudinal and transverse plasma waves from a plasma sphere is investigated. The general expressions of scattering cross sections are given and for the limiting cases well-known hydrodynamics and electromagnetic solutions are obtained. Furthermore, it is shown that by boundary coupling, incident longitudinal or incident transverse plasma waves generate longitudinal and transverse plasma waves in scattered and transmitted fields. It is found that pure acoustic type of radiation is possible only upon the incidence of a longitudinal wave on the plasma sphere. This mode of radiation is the lowest mode (zero mode) of the scattered waves. Light radiated from the incidence of longitudinal waves is not polarized, whereas the incident transverse waves generate polarized light. The problem of light scattering from a plasma sphere is treated, and as a special case, the results of the problem of Mie are derived. Furthermore, in Rayleigh-wave range, agreement with Born approximation solution is established. In this range of wave-lengths the lowest modes have scattering cross sections proportional to the fourth power of the wave number, and the scattered longitudinal waves are created more efficiently than the scattered transverse waves. (auth)

9502 ASYMMETRIC SELF-REVERSIBLE SPECTRAL LINE PROFILE AS A SOURCE OF INFORMATION ON PLASMA PROPERTIES. N. S. Gorbacheva and N. G. Preobrazhenskii. Opt. Spectry. (USSR) (English Transl.), 15: 244-6(Oct. 1963).

An attempt is made to derive the first variant of the phenomenological theory of the asymmetric self-reversal of a spectral line. (auth)

9503 ON WAVE PROPAGATION IN BEAM-PLASMA SYSTEMS. M. T. Vlaardingerbroek, K. R. U. Weimer, and H. J. C. A. Nunnink. Philips Res. Rept., 17: 344-62(Aug. 1962).

The dispersion equation of waves in a cylindrical waveguide completely filled with a number of beams of charged particles and with an infinite magnetic field in the direction of the axis is studied. A simple analytical method is developed, giving the dispersion diagrams of the nongrowing waves in such systems. The frequency bands where growing waves occur can then easily be found, because for each frequency the number of propagation constants satisfying the dispersion relation must be the same. The method described is also applicable to finding the ranges where non-convective instabilities occur. Two numerical examples of dispersion diagrams, calculated with the aid of a computer, for the nongrowing and for the growing waves in a waveguide filled with a beam and a plasma are given, both for the case with and without collisions of the plasma electrons. The method of the numerical calculation is explained. It is shown that the velocity of the wave front propagating in an infinite beam-plasma system never exceeds the beam velocity, even in regions of anomalous dispersion. The amount of energy propagating in a beam-plasma system is calculated for the case of growing waves in an infinite interaction region and appears to be zero when collisions of the electrons are neglected. For the nongrowing waves in a finite system the power flow can be related to the difference between the phase velocity and the group velocity. (auth)

9504 ON WAVE PROPAGATION IN BEAM-PLASMA SYSTEMS IN A FINITE MAGNETIC FIELD. M. T. Vlaardingerbroek and K. R. U. Weimer. Philips Res. Rept., 18: 95-108(Apr. 1963).

The dispersion equation is deduced for plane waves propagating in a set of spatially homogeneous parallel beams of charged particles. The direction of the wave vector is arbitrary while that of the external magnetic field is parallel to the beams. By means of this general dispersion equation the dispersion diagrams of waves in a beam-plasma system and propagating in the direction of the beam are constructed. The problem of wave propagation in a cylindrical waveguide containing a number of beams or a beam and a plasma is shown to be in some aspects mathematically equivalent to that of wave propagation through a generalized anisotropic medium as studied by Van Trier. (auth)

9505 STABILITY OF A CONTINUUM PLASMA. John W. Miles (Australian National Univ., Canberra). Phys. Fluids, 7: 223-8(Feb. 1964).

Weibel has considered the stability of a cylindrical

column of plasma, regarded as a viscous compressible fluid, that is confined by a combination of d-c and r-f magnetic fields. The integral equation in which the analysis culminates is considered. The normal modes are first determined for a d-c magnetic field and found to be definitely stable for all finite wavelengths and neutrally stable for infinite wavelengths. It then is shown that the addition of an r-f magnetic field renders a finite number of these modes unstable in certain spectral bands. This last result is based on the hypothesis that the strength of the r-f magnetic field is small compared with that of the d-c field (or small in some other appropriate sense), in consequence of which the modes of the plasma in the presence of the r-f magnetic field may be regarded as approximately independent. (auth)

9506 CONTINUUM THEORY OF A PLASMA. J. L. Jackson and L. S. Klein (National Bureau of Standards, Washington, D. C.). Phys. Fluids, 7: 232-41(Feb. 1964).

A continuum description of a classical plasma in equilibrium is presented. Thermodynamic properties and equilibrium fluctuations are discussed in terms of the fluctuations of the net charge density function n(r). The probability distribution function of the potential at a typical point and the joint distribution of the potential at two points are calculated. These results lead to the chemical potential and two-particle distribution function of classical Debye-Hückel theory. A first-order correction to the potential distribution of the continuum theory is obtained by treating the nearest neighbor charge as a discrete charge and the remainder of the plasma as a continuum. The corresponding correction to the free energy is obtained and compared with the results of diagrammatic calculations, to which these results are similar. (auth)

9507 SECULAR AND NONSECULAR BEHAVIOR FOR THE COLD PLASMA EQUATIONS. David Montgomery and Derek A. Tidman (Goddard Space Flight Center, Greenbelt, Md.). Phys. Fluids, 7: 242-9(Feb. 1964).

The origin of secular behavior for the nonlinear cold electron plasma equations is studied. The equations involved are closely related to the Klein-Gordon equation with a small nonlinear term. A method is developed for arriving at perturbation theoretic solutions of this equation, and the method is then applied to the case of the higher-order effects of an electromagnetic wave propagating in the cold electron plasma. An explicit expression for the second order frequency shift is calculated. (auth)

9508 FREQUENCY AND WAVELENGTH DEPENDENT ELECTRICAL TRANSPORT EQUATION FOR A PLASMA MODEL. Herbert L. Berk (Princeton Univ., N. J.). Phys. Fluids, 7: 257-62(Feb. 1964). (MATT-216)

The plasma model used by Dawson and Oberman is extended to frequencies embracing the collision frequency and to finite wavelengths. To the so-called dominant order, the collisional term is a Fokker-Planck equation that is frequency dependent. At low frequencies, the electrical conductivity is found to agree with conventional Lorentz-gas theories, while at high frequencies, the electrical conductivity is that predicted by Oberman and Dawson. The finite wavelength corrections to the electrical conductivity are obtained. (auth)

9509 BREMSSTRAHLUNG CROSS SECTIONS IN THE NEIGHBORHOOD OF THE PLASMA FREQUENCY. Ludwig Oster (Yale Univ. Observatory, New Haven). Phys. Fluids, 7: 263-8(Feb. 1964).

The spontaneous emission probability due to the bremsstrahlung mechanism for photons whose frequencies are not much higher than the plasma frequency is computed on the basis of classical radiation theory. The particle orbits are calculated using, for the electron-ion interaction potential, a Coulomb form that is cut off at the Debye distance. It is shown that for all practical purposes, shielding corrections can be neglected in computing the Fourier components of the acceleration, but must be applied for frequencies in the neighborhood of the plasma frequency, when the spectrum is averaged over collision parameters. If the respective assumptions on the underlying physical conditions are matched, results are identical with the results derived by Dawson and Oberman, and by Chang on the basis of kinetic theory. (auth)

9510 EXPERIMENTAL STUDY OF COMPRESSIONAL HYDROMAGNETIC WAVES. D. G. Swanson, R. W. Gould, and R. H. Hertel (California Inst. of Tech., Pasadena). Phys. Fluids, 7: 269-77(Feb. 1964).

An experiment is described in which a compressional hydromagnetic wave is observed in a hydrogen plasma-filled waveguide. The theory of a cool, partially ionized, resistive plasma in a magnetic field is described and expressions are derived for the dispersion relation and transfer function, which include both the propagation and attenuation constants as a function of frequency. Measurements of the cutoff frequency are presented, which verify its linear dependence on the magnetic field, and they show good agreement with theory on the variation with the ion mass density. The impulse response of the plasma is studied, transformed into the frequency domain, and quantitative comparisons are made with the theoretical transfer function to determine the degree of ionization, the resistivity, and the ion-neutral collision frequency. Results indicate that the degree of ionization varies over a range from 75 to 45% when the initial density varies from 1.3×10^{21} to 1.4×10^{22} atoms/m^3. The measured resistivity appears to increase with the magnetic field, with the mean value corresponding to a temperature of the order of 5×10^3 °K. The average value of the product of the charge exchange cross section and the neutral thermal speed is found to be approximately $(5.5 \pm 1.3) \times 10^{-15}$ m^3/sec. (auth)

9511 APPLICATION OF THE VIRIAL THEOREM TO EQUILIBRIA OF TOROIDAL PLASMAS. Shoichi Yoshikawa (Princeton Univ., N. J.). Phys. Fluids, 7: 278-83(Feb. 1964). (MATT-191)

Necessary conditions for equilibrium of a current-carrying toroidal plasma are derived under the assumption of azimuthal symmetry. It is demonstrated that it can be in equilibrium only if an additional transverse magnetic field is present that absorbs the expanding force of the plasma. An expression of parabolic pressure distribution is obtained for the plasma minor radius much smaller than the major radius. Stability criterion of the plasma ring against displacement is discussed. The weak focusing can be employed to stabilize the plasma ring. (auth)

9512 MACROSCOPIC TRANSPORT PROPERTIES OF A FULLY-IONIZED ALKALI-METAL PLASMA. N. Rynn (Princeton Univ., N. J.). Phys. Fluids, 7: 284-91(Feb. 1964). (MATT-204)

The one-dimensional macroscopic transport equations are solved for the special case of a fully ionized potassium plasma generated in the Q-device, and the solution is used to predict the volt-ampere characteristic. Agreement between predicted and measured volt-ampere characteristics is very good at low currents but not as good at high currents. The disparity is believed to be due to the presence of large potential and thermal gradients in front of the hot plates at high currents, which are predicted by the theory when the thermoelectric coefficients are taken into account.

The average experimentally determined electrical conductivity is 1.2 times the Spitzer-Härm value with an rms error of about 10%. The average experimentally determined thermal conductivity is 0.98 times their value with an rms error of about 10%. A criterion is established for determining when the sheaths in front of the plates do not affect the volt-ampere characteristic, and for determining when the plasma is truly collision-dominated. The axial variations of temperature and potential are also determined. A sudden change in the volt-ampere characteristic that coincides with the onset of instabilities in the plasma is not explained by the theory or by a simple interpretation of the sheath properties. The value of ln Λ was assumed to have a constant value of 7. (auth)

9513 ELECTROSTATIC WAVES IN BEAM-PLASMA SYSTEMS. B. N. A. Lamborn (Univ. of Florida, Gainesville) and D. L. Lafferty. Phys. Fluids, 7: 292-305(Feb. 1964).

By describing systems composed of a plasma and a set of moving nonrelativistic charged particle streams by means of collective coordinates, it is possible to discuss the collective interactions of the components of the system. The dispersion relation of an infinite beam-plasma system is found by requiring that the coupled equations of motion of these coordinates have a simultaneous solution. For a finite plasma the interaction is discussed in the limit where the time necessary for a beam particle to traverse the plasma is short. Two types of growing plasma waves are then possible. The first type is due to the coupling of the growing beam modes to the plasma modes. The second type occurs when the frequency of the beam oscillations match the background plasma frequency and leads to a linear growth of the plasma waves. (auth)

9514 INTERACTION OF A STATIONARY PLASMA WITH AN ELECTRON BEAM. Jacob Neufeld (Oak Ridge National Lab., Tenn.). Phys. Fluids, 7: 306-10(Feb. 1964).

A plasma-beam system in which an electron beam of small intensity interacts with a stationary plasma immersed in a magnetic field is investigated. Expressions are derived for frequencies and rates of growth of the transverse waves excited by the beam. It is shown that the rate of growth attains a maximum value for a beam velocity $\beta = \beta_m$, and a relationship is formulated between the quantity β_m and appropriate parameters characterizing the stationary plasma. An analysis is given of the behavior of the plasma-beam system in the neighborhood of ion gyroresonance. This investigation applies to all velocities of the electron beam except those in a highly relativistic range. (auth)

9515 DIFFUSION OF CHARGED PARTICLES ACROSS A MAGNETIC FIELD IN "SHORT CIRCUITING GEOMETRY." Fred Schwirzke (General Dynamics Corp., San Diego, Calif.). Phys. Fluids, 7: 311-?(Feb. 1964). (GA-4005)

The diffusion of plasma across a uniform magnetic field was studied in an experimental apparatus of variable length. It was possible to confirm, experimentally, the influence of the end walls upon a plasma of finite length in the direction of the field lines; this influence is called "short circuiting effect." By reducing the pressure from 2×10^{-3} to 5×10^{-5} mm Hg, an instability was found, and the diffusion coefficient reached a maximum. The onset of the instability was investigated as a function of pressure, magnetic field strength, and length of the plasma column. The results are compared with the analysis of Guest and Simon about the onset of an instability resulting from unequal streaming of ions and electrons to the conducting end walls, a phenomenon that should happen above a critical field or below a critical background pressure. (auth)

9516 ACCELERATION OF PARTICLES IN AN IONIZED GAS BY HIGH FREQUENCY FIELD AT A CYCLOTRON RESONANCE. T. Consoli (Centre d'Etudes Nucléaires, Saclay, France) and G. Mourier. Phys. Letters, 7: 247-8(Dec. 1, 1963). (In French)

9517 GROUND STATE ENERGY AND STABILITY PROBLEM OF A DEGENERATE ELECTRON GAS. S. Misawa (Univ. of Sheffield, Eng.). Phys. Letters, 7: 249-51 (Dec. 1, 1963).

Landau's theory of a Fermi liquid and its extension to the case of Coulomb interaction is used to determine whether the Coulomb interaction ever results in a ferromagnetic state at any electron density. A scheme is presented from this approach for evaluating the ground state energy of the system. The intermediate density range corresponding to actual metals is considered. (R.E.U.)

9518 TRAPPING OF PLASMA WITHOUT LEAKAGE. T. Consoli (Centre d'Etudes Nucléaires, Saclay, France). Phys. Letters, 7: 254-5(Dec. 1, 1963). (In French)

The principles of using the gradients of the electromagnetic and static magnetic fields in plasma containment are discussed. Magnetic toroidal cusp geometry is used to discuss an injection principle used for trapping without leakage. (R.E.U.)

9519 ON MAGNETO-ACOUSTIC WAVES. Yoshihito Takesada (College of Education, Kyoto). Phys. Letters, 7: 256-7(Dec. 1, 1963).

A solution is obtained for the induced magnetic field caused by the propagation of sound waves through an electrically conducting medium in a direction parallel to the original magnetic field. The equation of continuity is introduced into the coupled equations for the hydrodynamic flow and the electromagnetic field. (R.E.U.)

9520 PLASMA OSCILLATIONS IN A MAGNETIC FIELD. M. J. Stephen (Univ. of California, La Jolla, Calif.). Phys. Letters, 7: 258-9(Dec. 1, 1963).

A derivation of the dispersion relation for longitudinal oscillations of a plasma in a uniform magnetic field is presented. (R.E.U.)

9521 THE MELTING LINE AND INTERMOLECULAR POTENTIAL OF ARGON FROM SHOCK COMPRESSION. B. J. Alder and M. Van Thiel (Univ. of California, Livermore). Phys. Letters, 7: 317-19(Dec. 15, 1963). (UCRL-7491-T)

Liquid argon, initially two degrees above its melting point, is shown to be shock compressed into the two-phase solid-liquid region between 0.8 and 45 k bar and re-enters the fluid phase above 45 k bar. The experimental shock measurements are illustrated for low and high pressures, and are compared with the theoretical Hugoniot and the cell theory. (L.B.S.)

9522 NON-LINEAR POLARISATION IN A PLASMA. F. W. Sluijter (FOM-Instituut voor Plasma-Fysica, Rijnhuizen, Netherlands). Phys. Letters, 7: 325-6(Dec. 15, 1963).

An expression which explicitly gives the resonance behavior of the first harmonic polarizability of free electrons in a low-temperature plasma is derived. (L.B.S.)

9523 LONGITUDINAL OSCILLATIONS IN A NON-UNIFORM PLASMA. F. C. Hoh (Royal Inst. of Tech., Stockholm). Phys. Rev., 133: A1016-20(Feb. 17, 1964).

Longitudinal electron oscillations in a bounded plasma slab immersed in a magnetic field are analyzed using hydrodynamic equations. Resonance conditions are given

for an arbitrary density distribution. In the zero magnetic field limit, the results may account for some main features of Tonks' and Dattner's experiments. The behavior of these resonances and the possibility of damping due to thermal effects are discussed. It is found that the magnetic field tends to push the perturbations further into regions near the walls and keep the bulk of the plasma free from oscillations. (auth)

9524 EXCITATION OF LOW-FREQUENCY WAVES IN A CURVED MAGNETIC FIELD GEOMETRY. N. D'Angelo, D. Eckhartt, G. Grieger, E. Guilino, and M. Hashmi (Max-Planck-Institut fur Physik und Astrophysik, Munich and Institut fur Plasmaphysik GmbH, Garching, Ger.). Phys. Rev. Letters, 11: 525-7(Dec. 15, 1963).

Low frequency oscillations were observed in a Cs plasma produced by contact ionization of Cs atoms on a hot (2300°K) Ta plate. A curved magnetic field geometry was used, and measures were taken to avoid an ion sheath at the Ta plate. Two modes of oscillation (5–8 and 12–15 kc/sec) were observed. The relative amplitude of the oscillations as a function of radial position and the phase relation between pairs of points at different locations in the column were measured. Such waves were previously observed in a straight magnetic field geometry with an ion sheath. (D.C.W.)

9525 ALTERNATIVE APPROACH TO THE PROBLEM OF PRODUCING CONTROLLED THERMONUCLEAR POWER. E. R. Harrison (National Inst. for Research in Nuclear Science, Chilton, Berks, Eng.). Phys. Rev. Letters, 11: 535-7(Dec. 15, 1963).

A brief analysis is presented of power production by collisions of macroscopic particles accelerated to 10^8–10^9 cm sec^{-1} with other particles or a target, thereby converting their kinetic energy to thermal energy that is inertially confined to a small region for a short time. (D.C.W.)

9526 DYNAMICAL INSTABILITY OF GASEOUS MASSES APPROACHING THE SCHWARZSCHILD LIMIT IN GENERAL RELATIVITY. S. Chandrasekhar (Univ. of Chicago). Phys. Rev. Letters, 12: 114-16(Jan. 27, 1964).

The question of stability of gaseous masses as they approach the Schwarzschild limit is examined in the framework of general relativity. It is shown that gaseous masses become dynamically unstable well before they reach the Schwarzschild limit. A discussion of the stability of gaseous masses with respect to purely radial oscillations on the basis of Einstein's field equations is presented. (C.E.S.)

9527 UNIVERSAL INSTABILITY IN A FULLY IONIZED INHOMOGENEOUS PLASMA. Herbert Lashinsky (Princeton Univ., N. J.). Phys. Rev. Letters, 12: 121-3 (Feb. 3, 1964). (MATT-234)

Low-frequency oscillations of a fully ionized inhomogeneous cylindrical cesium plasma column in a magnetic field that were identified as normal modes of the universal instability are reported. The experiments were performed at densities of (1 to 4) × 10^{-11} cm^{-3} with magnetic fields ranging from 3000 to 5000 gauss. (C.E.S.)

9528 IMPROVED QUIESCENT PLASMA SOURCE. Nathan Rynn (Princeton Univ., N. J.). Rev. Sci. Instr., 35: 40-6(Jan. 1964). (MATT-219)

A source of low-temperature, fully ionized, quiescent plasma, known as the Q-1 device, is described. A simplified form of the theory is presented and is extended to include absorption at the walls. The many modifications and improvements that have been made since the device was first built are described. (auth)

9529 INDUCTION INTERACTION OF AN EXPANDING PLASMA CYLINDER WITH AN EXTERNAL ELECTRIC CIRCUIT. V. I. Yakovlev. Zh. Priki. Mekhan. i Tekhn. Fiz., No. 2, 31-8(Mar.-Apr. 1963). (In Russian)

Inducted external current and magnetic field variations inside the plasma were calculated. It was assumed that no magnetic field existed in the plasma at the initial moment. The obtained data were used for calculating the work done by a plasma against magnetic field, the energy exerted by the external current, and the heat loss in the plasma. The critical Reynold's number for determining energy recoil into the external circuit during plasma pulsing was found. The data are useful for determining the efficiency of moving plasma energy transformation into electric energy. (R.V.J.)

9530 EXCITATION OF LOW FREQUENCY OSCILLATIONS OF MAGNETOACTIVE PLASMA INDUCED BY CHARGED PARTICLE FLUX. D. G. Lominadze and K. N. Stepanov (Inst. of Physics, Academy of Sciences, Georgian SSR and Inst. of Physics and Tech., Ukrainian SSR). Zh. Tekhn. Fiz., 33: 1311-14(Nov. 1963). (In Russian)

Excitation of low-frequency longitudinal plasma oscillations in a magnetic field by charged particle fluxes was studied for the case of quasitransverse wave propagation (where the angle between the k vector and the magnetic field is close to $\pi/2$). (tr-auth)

9531 THE STRUCTURE OF A SEPARATE WAVE PROPAGATING ALONG MAGNETIC FIELD. A. D. Patarraya (Inst. of Physics, Georgian SSR, Tblisi). Zh. Tekhn. Fiz., 33: 1315-17(Nov. 1963). (In Russian)

Propagation of ordinary and extraordinary waves in quasi-neutral plasma along a magnetic field was studied previously by means of nonlinear approximation. It was shown that a longitudinal electric field is developed due to the electron–ion mass difference. The charge separation effect and the influence of the effect on plasma magnitudes are analyzed by perturbation theory. (R.V.J.)

9532 EFFECTS OF IONIC WIND ON ROTATION OF PLASMA IN CROSSED FIELDS. K. V. Donskoi, E. M. Dobryshevskii, and E. V. Nazarov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 33: 1328-32 (Nov. 1963). (In Russian)

Effects of Lorentz force and ionic wind, produced by ion motion in the direction of an electric field, on accelerated plasma in crossed fields were analyzed. In certain regions variations in magnetic field may be expressed by Lorentz force. In the case of rotating plasma the ionic wind is capable of equalizing the effects of centrifugal force. (R.V.J.)

9533 EFFECTS OF HALL CURRENT ON PLASMA ROTATION IN CROSSED FIELDS. E. M. Dobryshevskii (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 33: 1338-43(Nov. 1963). (In Russian)

An analysis was made of Hall current effects on electric and gasodynamic parameters of weakly ionized plasma rotating in a space between two coaxial cylindrical electrodes. The Hall effect induced an increased magnetic field in the positive electrode and weakened the field in the negative electrode, thus making the plasma parameters a function of applied current polarity. The effect is more pronounced in weakly ionized plasma with conductivity based on electron mobility. With large current and magnetic field magnitudes the Hall effect disappears. (R.V.J.)

9534 SCATTERING AND TRANSFORMATION OF WAVES IN MAGNETOHYDRODYNAMIC FLUCTUATIONS. A. G. Sitenko and Yu. A. Kirochkin (Inst. of Physics,

Academy of Sciences. Ukrainian SSR and Khar'kov State Univ.). Zh. Tekhn. Fiz., 33: 1354-65(Nov. 1963). (In Russian)

Scattering and mutual transformations of various hydromagnetic waves produced by thermal fluctuations in magnetohydrodynamic media were investigated using an unlimited, ideal, infinitely-conducting, compressed fluid in an external constant magnetic field. Spectral and angular distributions were found for scattered wave intensities. (tr-auth)

9535 ION OSCILLATIONS IN PLASMA WITH MOLECULAR IONS. A. V. Bogdanov (Moscow Regional Teacher's Coll.). Zh. Tekhn. Fiz., 33: 1366-9(Nov. 1963). (In Russian)

Ion oscillations were investigated in plasma with di- or multi-atomic ions. An analysis was made of dispersion equations for non-isothermal plasma in which $T_e > T_c$. (tr-auth)

9536 INVESTIGATION OF PLASMA DECAY IN MAGNETIC FIELD BY THE RESONATOR METHOD. A. I. Anisimov, N. I. Vinogradov, and V. E. Golant (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 33: 1370-7(Nov. 1963). (In Russian)

Experimental studies were made of plasma decay in 5 to 10 mm diameter cylindrical vessels filled with 0.05 to 0.5 mm Hg helium pressure, (10^{10} to 10^{12} cm^{-3} particle concentrations) in 6000 to 8000 gauss magnetic fields. A superhigh frequency resonance method was used for measuring particle concentrations during plasma decay. It was established theoretically that the coefficient of charged particle diffusion is inversely proportional to the square of the magnetic field intensity. Experimental data differ from the theoretical diffusion coefficient by an order of 2 to 3. (tr-auth)

9537 ON THE DECAY INSTABILITY OF WAVES IN PLASMA WAVEGUIDES. A. N. Kondratenko (Khar'kov Inst. of Physics and Tech.). Zh. Tekhn. Fiz., 33: 1397-9 (Nov. 1963). (In Russian)

Wave decay instabilities (in which an instability with a frequency ω excites two other waves with a different frequency, phase velocity, and in some cases different oscillations) were analyzed previously. Such decay has a nonlinear character and induces energy transfer from one wave to another. An analysis was made of a wave decay instability in a cylindrical plasma waveguide in an infinitely strong magnetic field ($\omega_e^2 > \Omega_e^2$) in which an infinite number of waves correspond to one frequency. The final equations show that in the case in which two waves propagate in opposite directions the initial wave decay ($\omega^{(1)2} < 0$) divides into two waves with ω_1 and ω_2 frequencies. (R.V.J.)

9538 ON CERTAIN PROPERTIES OF TOROIDAL DISCHARGE. A. P. Babichev, A. I. Karchevskii, and Yu. A. Muromkin. Zh. Tekhn. Fiz., 33: 1400-3(Nov. 1963). (In Russian)

A toroidal installation was used for experimental investigations of gas discharge stabilization by weak longitudinal magnetic fields. The discharge chamber consisted of 12 isolated 4-mm thick aluminum sections. The discharge was initiated in a hydrogen atmosphere at 5×10^{-4} to 5×10^{-3} mm Hg with an initial longitudinal magnetic field of 300 to 700 gauss and 40 ka discharge currents. It was observed that discharge oscillations begin only when the H_φ/H_z ratio on the channel periphery is sufficiently high. The oscillations continue until the discharge is complete. The discharge reacts at several time intervals (depending on current) during which the azimuthal and longitudinal magnetic field components remain constant. Magnetic field configurations do not change monotonously; there are periods during which the discharge current rises but the configuration remains the same. Oscillograms show that after reaching a maximum the discharge current starts to drop stepwise with partial current breakdown caused by electron beam instability. However, this latter postulation is not yet clear and should be investigated further. (R.V.J.)

9539 MEASUREMENTS OF VELOCITY AND ELECTRIC CONDUCTIVITY OF IONIZED GAS FLUX. L. P. Poberzhskii. Zh. Tekhn. Fiz., 33: 1464-9(Dec. 1963). (In Russian)

Electrodynamic methods are suggested for measuring simultaneously the velocity and electric conductivity of ionized gas. The results of measurements on rarefied plasma are tabulated. (R.V.J.)

9540 ON ONE OF PLASMA HEATING PROPERTIES IN TOROIDAL SYSTEMS. G. V. Skornyakov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 33: 1477-8(Dec. 1963). (In Russian)

Plasma heating in toroidal fields can be accomplished by ohmic heating with electrical field components parallel to the magnetic field or by magnetic pumping with the electric field perpendicular to the magnetic field. It is shown that an electric field component parallel to the magnetic field is possible during magnetic pumping in complex fields with pulsating confining fields. (R.V.J.)

9541 ON THE STABILITY OF MAGNETIC FIELD TOPOLOGY. G. V. Skornyakov (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Tekhn. Fiz., 33: 1478-82(Dec. 1963). (In Russian)

Effects of topological characteristics in complex toroidal magnetic systems on the development of magnetic traps for plasma containment and heating were analyzed. The stability of magnetic field topology is conditioned by a magnetic boundary layer with variable rotations. Two classes of toroidal magnetic systems, each with a stability area, are analyzed. (R.V.J.)

9542 RETARDATION OF RELATIVISTIC PARTICLES IN PLASMA. A. I. Alekseev. p.65-82 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

A Green's function approach was used to find the general formula for energy losses by charged particles passing at arbitrary rates through multicomponent plasma at various temperatures. A detailed analysis was made of the region of nonrelativistic plasma temperature and arbitrary particle velocity. (tr-auth)

9543 EMISSION FROM HIGH TEMPERATURE PLASMA. A. I. Alekseev and M. A. Troitskii. p.83-93 of "Primenenie Methodov Kvantovoi Teorii Polya k Zadacham Mnogikh Tel." Moscow, Gosatomizdat, 1963.

Quantum field theory and statistical physics were used in an investigation of bremsstrahlung emission from high-temperature plasma in a constant magnetic field. The bremsstrahlung spectrum was determined considering Coulomb ion screening. (tr-auth)

9544 NONLINEAR WAVE MOTION IN AN INFINITE CYLINDRICAL PLASMA CONFINED BY A MAGNETIC FIELD. Chong-Wei Chu. Minneapolis, Univ. of Minnesota, 1963. 159p.

The motion of a magnetically confined infinite cylindrical plasma, a linear pinch, due to finite axi-symmetrical disturbances is studied. The plasma is considered as a single, inviscid, perfectly conducting, compressible fluid, and the usual magnetohydrodynamic assumptions are made. Two one-dimensional models are investigated. The first model

is an infinite cylindrical plasma confined by a uniform axial magnetic field and housed in a co-axial, perfectly conducting, cylindrical wall; the second model is confined by an azimuthal magnetic field and has an internal, initially axial and uniform magnetic field. All disturbances have an initially small area gradient in the axial direction. The theory of characteristics is applied to the first model, since the governing differential equations are hyperbolic. Simple waves are studied. A shock wave solution is worked out in some detail. Since the shocks involve area changes, which are analogous to density changes in compressible flow, incompressible shocks exist and are studied. The governing differential equations for the second model are of mixed type. The theory of characteristics is again used in the hyperbolic region. In the elliptic region, however, use is made of the maximum principle to give qualitative results. Some conditions for instability are established. Through the hodograph transformation, the initial value problem is converted to the generalized Cauchy problem for a second order linear equation. A method of finding infinitely many particular solutions of the hodograph equation is given. Results obtained for the 2 models are discussed. (M.P.G.)

9545 NON-LINEAR STABILITY OF THE EXTRAORDINARY WAVE IN A PLASMA. Robert David Engel. Thesis, Los Angeles, Univ. of California, 1963. 152p.

The nonlinear stability and growth characteristics of the extraordinary or right-hand circularly polarized wave in a collisionless plasma are discussed. A review of the linear theory is presented from the kinetic theory point of view. The mechanism responsible for the growth (decay) of the extraordinary waves is investigated by using a simplified model for the behavior of the plasma. It is shown that the work done by (on) the electric field of the wave accounts for the energy exchanged between the wave and the resonant electrons. The nonlinear behavior of the system is analyzed by using a type of WKB approximation. The analysis is restricted to infinite homogeneous plasmas where the background distribution and the wave energy density may be considered as slowly varying functions of time. A set of nonlinear integro-differential equations, which describe the evolution of the system, are derived and discussed. These equations show that the waves cause the background distribution to diffuse in velocity space in such a way as to reduce the anisotropy of the distribution and hence growth rate of the waves. This leads to the establishment of an equilibrium spectrum of waves which is of finite amplitude. The wave energy is furnished by the decrease in the kinetic energy of the resonant particles. For the physically interesting case where the wave frequency (ω) is much less than the cyclotron frequency (ω_c), it is shown that the main diffusion of the background distribution occurs along the v = constant lines in velocity space, in which v is the magnitude of the velocity. Since these lines are also constant energy lines, the kinetic energy of the particles changes very little during the diffusion process. Therefore, the energy transferred to the waves is small, and the unstable extraordinary waves do not represent a serious energy loss for the systems we have considered. A Maxwellian plasma which has been disturbed by injecting a stream of electrons into it is considered as an example. The equilibrium solutions are estimated, and it is shown that only ~3% of the stream energy is given to the extraordinary waves before equilibrium is reached. (M.P.G.)

9546 THE STABILITY OF A DISSIPATIVE PLASMA. H. E. Wilhelm. Thesis, Stuttgart, Technische Hochschule, 1962. 71p. $2.00(Gmelin, AED-DISS. 62-502)

The stability of axially symmetric plasma configurations with arbitrary current density is studied using the method of small perturbations. Dissipative transport processes and momentum transport are taken into account by electric conductivity and viscosity, respectively. In the unperturbed state, a local equilibrium between gas kinetics and magnetic tensions is assumed. The influence of various parameters on plasma stability is discussed. (Gmelin Inst.)

9547 MEASUREMENT OF PLASMA PROPERTIES BY MEANS OF PROBE TECHNIQUES. Sol Aisenberg (Raytheon Co., Waltham, Mass.). 41p. (CONF-284-7)

From National Electronics Conference on Adaptive Processes, Chicago, Oct. 1963.

Considerable information about local properties and processes in d-c and r-f plasmas can be obtained by means of probe measurements. From the probe characteristic, which corresponds to the measurement of probe current as a function of probe-plasma potential difference, the electron density, the electron temperature, the plasma potential, and the actual electron energy function can be determined. Diffusion and mobility coefficients in active discharges can also be obtained from interpretation of the probe data. The problem of multiple probe measurements in electrodeless discharges is considered along with possible sources of error. A triple probe method developed for use in diagnostic measurements in laser plasmas is described. Typical results are shown for mercury, cesium, and rare gas plasmas. (auth)

9548 DIAGNOSIS OF PLASMA CYLINDERS BY ANGULAR SCATTERING OF MICROWAVES. Ronald L. Easley (Redstone Arsenal, Ala.). 75p. (CONF-328-4)

From American Physical Society Southeast Section 1963 Spring Meeting, Knoxville, Tenn., Apr. 1963.

The determination of the electron density and collision frequency of a plasma cylinder through the measurement of the angular distribution of free-space electromagnetic waves scattered by the cylinder was investigated experimentally. A 20 kilowatt, d-c arc, argon plasma jet formed a cylindrical plasma requiring no containing walls. Angular scattering distributions were measured at 35 and 72 kmc. A 72-kmc microwave interferometer provided an independent measurement of the plasma properties. Predicted values for the magnitude and phase of the scattered field were obtained, using an IBM 7090 computer to solve the scattering problem for a homogeneous, infinitely long plasma cylinder having a range of electron densities and collision frequencies. The plasma jet was found to have a rapidly decreasing electron density as a function of radius. The value of angular scattering measurements in determining the properties of such inhomogeneous plasma cylinders is shown. (auth)

9549 THE MAGNETO GAS DYNAMIC ANALOG OF CERENKOV RADIATION. [PART] I. A. Cantor and J. Farber (Sylvania Electronic Systems, Waltham, Mass.). 24p. (CONF-363-8)

From International Symposium on Plasma Phenomena, San Diego, Calif., Oct. 1963.

The Green's function for small-signal radiation in a magnetized, zero-temperature, collisionless, fully-ionized electron-ion plasma is evaluated in the frequency range below the ion cyclotron frequency. This is the simplest function to illustrate the directional properties of Alfven-like waves generated in a compressible conducting fluid. The radiation Green's function is an anisotropic matrix of functions exhibiting five distinct kinds of response to a point excitation. Firstly, there is the excited field that occurs even in the absence of an external magnetic field.

Secondly, there is a signal that is propagated at the Alfven phase-velocity equally in all directions, and that is characteristic of the compressible fluid. Thirdly, there is a signal that is propagated inside a double-cone centered on a magnetic field line with apex at the source point, and which is damped outside of the cone. The narrowness of the cone varies with the emitted frequency, becoming most narrow at the lowest frequencies. It is this that corresponds to the Alfven mode (propagation along the magnetic field) observed in incompressible conducting fluids. The fourth and fifth kinds of behavior are caused by the interference or competition of the Alfven-mode with each of the first and second kinds of behavior. (auth)

9550 AN ELECTROSTATIC PLASMA CONTAINMENT SYSTEM AND ELECTRON MOTION THROUGH GRIDS. R. G. Herb (Univ. of Wisconsin, Madison). 25p. (CONF-340-9)

From American Physical Society 1963 Autumn Meeting, Chicago, Oct. 1963.

Grids consisting of arrays of fine wires to form cylindrical surfaces were used in getter-ion pumps. They have been shown to be plasma containers holding ions and electrons up to densities of 3×10^8 per cm^3. A discussion is given of the motion of electrons through grids. Limitations on the mean free path of electrons are discussed. A method is described for obtaining high currents of positive ions. (auth)

9551 MICROWAVE NOISE MEASUREMENT OF ELECTRON TEMPERATURES IN AFTERGLOW PLASMAS. C. C. Leiby, Jr. and W. D. McBee (Sperry Rand Research Center, Sudbury, Mass.). 21p. (CONF-364-2)

From 16th Annual Gaseous Electronics Conference, Pittsburgh, Oct. 1963.

Transient electron temperatures in afterglow plasmas were determined for He (5 and 10 torr), Ne, and Ne + 5% Ar (2.4 and 24 torr) by combining measurements of plasma microwave noise power, and plasma reflectivity and absorptivity. Use of a low-noise parametric preamplifier permitted continuous detection during the afterglow of noise power at 5.5 Bc in a 1 Mc bandwidth. Electron temperature decays were a function of pressure and gas but were slower than predicted by electron energy loss mechanisms. The addition of argon altered the electron density decay in the neon afterglow but the electron temperature decay was not appreciably changed. Resonances in detected noise power vs time in the afterglow were observed for two of the three plasma waveguide geometries studied. These resonances correlate with observed resonances in absorptivity and occur over the same range of electron densities for a given geometry independent of gas type and pressure. (auth)

9552 ELECTRON ENERGY DECAY IN HELIUM AFTERGLOW PLASMAS AT CRYOGENIC TEMPERATURES. P. D. Goldan, J. H. Cahn, and L. Goldstein (Univ. of Illinois, Urbana). 13p. (CONF-364-3)

From 16th Annual Gaseous Electronics Conference, Pittsburgh, Oct. 1963.

Studies of decaying afterglow plasmas in helium were made in which the neutral parent gas is maintained near $4^\circ K$ by immersion in a liquid helium bath. By means of a Maser Radiometer System, the electron temperature was followed below $200^\circ K$. Guided microwave propagation and wave interaction techniques permit determination of electron number density and collision frequencies for momentum transfer. Electron temperature decay rates of the order of 150 μsec/p (mm Hg α $4.2^\circ K$) were found. Since thermal relaxation by elastic collisions should be some two orders of magnitude faster than this, the electrons appear to be in quasiequilibrium with a slowly decaying internal heating source. Correlation of the expected decay rates of singlet metastable helium atoms with the electron temperature decay gives good agreement with the present experiment. (auth)

9553 IMPROVEMENTS RELATING TO THE PRODUCTION OF HIGH-INTENSITY MAGNETIC FIELDS. (to European Atomic Energy Community). British Patent 942,705. Nov. 27, 1963. Priority date Dec. 28, 1960, Italy.

The magnetic field to be amplified is produced at the center of a cylindrical vacuum chamber. An iron or steel envelope surrounds the chamber and a chemical explosive surrounds the envelope. The azimuthal field of a conductor is compressed by the implosion of the metal envelope induced by the explosion of the external annular chemical explosive. The axial conductor is formed by a column of ionized gas through which an electric current passes. This apparatus is capable of 10^7 gauss. (R.E.U.)

9554 PROCESS AND APPLIANCE FOR PRODUCING INTENSE MAGNETIC FIELDS FOR THE PURPOSE OF CONFINING A PLASMA. Jiri George Linhart. British Patent 942,706. Nov. 27, 1963. Priority date July 5, 1960, Belgium.

A process is described in which a gas is introduced peripherally into a highly evacuated cylindrical enclosure immediately after a central plasma column is produced in it. The gas is subjected to a series of electric discharges coaxial with the central plasma column and is caused to assume the shape of a centripetally moving annular column that compresses the azimuthal field confining the central plasma column. The annular column is formed from a sheet of lithium or aluminum and the central column of plasma is an ionized mixture of deuterium and tritium that is obtained by vaporizing a wire of tritiated lithium deuteride. The electric discharges are of the order of several tens of kilovolts at a hundred per second. Magnetic fields of several megagauss are possible. (R.E.U.)

Shielding

9555 (DASA-11.026) COMPUTER CALCULATION OF DOSE RATES IN TWO-LEGGED DUCTS USING THE ALBEDO CONCEPT. Technical Report R 264. J. M. Chapman (Naval Civil Engineering Lab., Port Hueneme, Calif.). Oct. 24, 1963. 27p.

The results of calculations of gamma-ray dose rates in two-legged rectangular concrete ducts are given. The calculations are based on the differential dose albedo and include multiple scattering effects. The results of the calculations are compared with experimental data for ducts whose widths vary from 11 in. to 6 ft, using Co^{60}, Cs^{137}, Au^{198}, and Na^{24} gamma-ray sources. The calculated dose rates agree to within ±30% for all ducts and all sources, except for small ducts with Cs^{137} sources, ducts with very short first legs ($L_1/W \leq 1.33$), and for Au^{198} sources. (auth)

9556 (ORNL-3464) A STUDY OF THE RADIATION SHIELDING CHARACTERISTICS OF BASIC CONCRETE STRUCTURES AT THE TOWER SHIELDING FACILITY. V. R. Cain (Oak Ridge National Lab., Tenn.). Jan. 24, 1964. 65p. Contracts W-7405-eng-26 and OCD-OS-62-145.

In the first of a series of experiments performed to investigate the protection afforded by various typical structures against prompt weapons radiation, radiation-intensity measurements were made at the Tower Shielding

Facility in two concrete-shielded bunkers and in an interconnecting tunnel. Prompt weapons radiation was simulated by the Tower Shielding Reactor II, which was operated 100 ft above the ground. The distance between the reactor and the bunkers was approximately 700 ft. The bunkers were each 12-ft cubes and were constructed so that the shield thickness on the front face of one and on the top face of the other could be varied in 4-in. steps from 0 to 20 in. The thickness of concrete and dirt surrounding all other faces was sufficient to make them black to incident radiation. The immediate goals of the experiment were to study (1) the attenuation of radiations by various thicknesses of ordinary concrete slabs, (2) the buildup of radiation intensities within the cavities by scattering of radiation in the walls, and (3) the transmission of radiation down a tunnel with two right-angle bends. The gamma-ray and fast-neutron dose rates and thermal-neutron fluxes measured at various positions within the bunkers and in the tunnel and the pulse-height spectra from a 3-in. sodium iodide crystal determined at one position in the top bunker and one position in the tunnel are reported. (auth)

9557 (ORNL-3507) CALCULATIONS OF THERMAL-NEUTRON FLUX DISTRIBUTIONS IN CONCRETE-WALLED DUCTS USING AN ALBEDO MODEL WITH MONTE CARLO TECHNIQUES. V. R. Cain (Oak Ridge National Lab., Tenn.). Jan. 27, 1964. Contract W-7405-eng-26. 192p.

Thesis submitted to Univ. of Tennessee, Knoxville.

When radiation shields are penetrated by ducts, the gamma rays resulting from the radiative capture of low-energy neutrons in the duct walls can be principal contributors to the total dose along the duct. In order to calculate the effect of these capture gamma rays, the distribution of low-energy neutrons in the ducts must be known. This report presents calculations of low-energy neutron distributions in concrete-walled ducts by a method in which an albedo model and a Monte Carlo technique were used. One series of calculations was performed for straight ducts so that comparisons could be made with the Simon-Clifford analytic approximation. Another series was for three-legged rectangular ducts similar to those used in a Tower Shielding Facility experiment. When an albedo similar to that to be expected for a pure thermal-neutron source was used, the results agreed very closely with the TSF data. A digital computer code was written to perform the calculations. (auth)

9558 (ORNL-3520) SPACE VEHICLE SHIELDING STUDIES. PART II. THE ATTENUATION OF SOLAR FLARES BY ALUMINUM SHIELDS. R. G. Alsmiller, Jr., and J. E. Murphy (Oak Ridge National Lab., Tenn.). Jan. 24, 1964. 26p. Contract W-7405-eng-26.

Using the straight-ahead approximation, nucleon-meson cascade calculations were carried out for several solar-flare proton spectra incident on a shield. The shield material has approximately the properties of aluminum. Both spherical-shell and slab geometries are considered. (auth)

9559 ENERGY DISTRIBUTION OF γ-RADIATION IN A MATERIAL MEDIUM. A. A. Sazonov and V. I. Sirvidas. At. Energ. (USSR), 15: 420-2(Nov. 1963). (In Russian)

Various simplifying assumptions were used in the past to overcome the difficulties arising from a strict mathematical determination of the passage of γ rays through a medium. The energy spectrum was determined for small scattering angles under given boundary conditions by making use of the equations derived by V. I. Oglevetskiĭ (Zhur. Eksper. i Teoret. Fiz. 29, 459 (1955)), estimating the probability of the creation of scattered γ quanta by Compton scattering within a given wavelength region from a primary quantum. Expressions were obtained for the case when the spectrum consists of n γ lines by approximating the original function on the basis of a graduated function. The formulas obtained may be used for determining the energy distribution of γ radiation in a material medium. The accuracy of the calculation, which depends on the energy of the primary radiation and the depth of penetration into the medium, increases with the energy and the depth. In order to evaluate the practical applicability of the method, the energy distribution of the 320-kev γ radiation of Cr^{51} in sand was determined; the numerical values were found to agree with previously obtained experimental data. (TTT)

9560 SCATTERING OF GAMMA-RAYS. IV. BACK-SCATTERING FROM SOME SCATTERERS OF A FINITE THICKNESS (i). Tokishi Kaminishi (Government Industrial Research Inst., Nagoya, Japan). Nagoya Kogyo Gijutsu Shikensho, Hokoku 12: 438-49(Sept. 1963). (In Japanese)

Preliminary experiments on backscattering of collimated gamma rays from Cs^{137} were made with various arrangements of a scatterer and a detector. Concrete, iron, and lead of various thicknesses were used as scatterers. The scattering intensity and the energy spectrum for each were measured at a spatial point behind the scatterer as a function of incident angle α, escaping angle β, thickness of the scatterer, etc. Some of the observed data were compared with theoretical estimations. Multi-scattering components in an observed energy spectrum of backscattered rays were determined by the difference method. Some qualitative information on multi-scattering could be obtained as follows: (1) The energies of most multi-scattered rays are in the range of 100 to 200 kev. This range is roughly independent of values of β, but the shape of the spectrum varies with β. (2) The number of multi-scattered rays increases with the escaping angle. (3) Multi-scattering intensity is proportional to thickness, t, of a scatterer for $t \geq \lambda_0$ and maybe to t^2, if $t \ll \lambda_0$. (4) Multi-scattering intensity saturates at a thickness equal to about $2\lambda_0$. The relation between the scattering intensity at a spatial point and a number albedo calculated is discussed briefly. (auth)

9561 DOUBLE-P_m SOLUTIONS TO THE GAMMA-RAY TRANSPORT EQUATION BY THE MOMENTS METHOD. Myron Hwai-Hsi Yang. (Thesis, Raleigh, N. C., North Carolina State Coll., 1963.) 103p.

The double spherical harmonic method of Yvon was applied to γ-ray penetration problems in slab geometry and infinite media. Calculations were made for energy spectra, dose and energy buildup factors, and dose angular distributions. The spatial variation was treated with the moments method of Spencer and Fano, together with a polynomial reconstruction procedure. The results, when compared with ordinary spherical harmonic calculations, indicate that the double P-3 approximation gives about the same accuracy as the P-7 approximation, and that the double P-1 approximation compares favorably with the P-3 approximation. The spatial moments method for the double spherical harmonic treatment of the angular variation has the disadvantage of requiring considerably more computational time than for the ordinary spherical harmonic treatment. (Dissertation Abstr.)

REACTOR TECHNOLOGY

General

Refer also to abstracts 8475 and 8919.

9562 (HW-78388) RESEARCH AND DEVELOPMENT PROGRAMS EXECUTED FOR THE DIVISION OF REACTOR DEVELOPMENT. Quarterly Progress Report, April–June 1963. M. M. Hendrickson and J. K. Green, eds. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 1963. Contract AT(45-1)-1350. 133p.

Progress is reported on reactor development. Topics covered include: analytical studies and advanced concepts, chemical research and development, fuel studies, gas-cooled reactor studies, instrumentation and nondestructive testing, irradiation effects on materials, materials development, physics, and Plutonium Recycle Test Reactor. Separate abstracts were prepared for each section. (M.C.G.)

For abstracts of individual sections see: 8445, 8721, 8752, 8865, 8866, 8912, 9615, and 9646.

9563 (IDO-11400) ECONOMICS OF HYDROCRACKING DAMAGED COOLANT FROM ORGANIC REACTORS. J. L. Griffith and G. J. Russell (Idaho Operations Office, AEC). Nov. 1963. 56p.

The economics and capabilities of catalytic hydrocracking processes as applied to organic reactor coolant is discussed. The hydrocracker concept is capable of resolving several important technical and economic problems associated with organic coolants. The unit reconstitues damaged organic coolant, maintains the coolant material in a clean condition which substantially reduces fuel element fouling, and allows coolant makeup cost to be greatly reduced. The report describes the advantages of installing several types of hydrocrackers on the Piqua Nuclear Power Facility and recommends a flash tank fed unit. Included is a brief economic study of a flash tank fed hydrocracker for a 500 Mw(e) organic cooled-heavy water moderated reactor. (auth)

9564 (KAPL-M-CWS-8) DPL—A PHILCO-2000 DIGITAL COMPUTER PROGRAM DECAY POWER LEVEL. C. W. Sorenson (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 1963. Contract W-41-109-eng-52. 23p.

The program DPL, which calculates the decay power level and integrated decay heat since shutdown as a function of time since shutdown following a power history of up to 36 sections, is described. Calculation of the cooling water required to remove the decay heat and the temperature rise due to decay heat with a specified coolant flow rate is optional. The calculational method is described, and the accuracy of the calculations is considered. (auth)

9565 (SRIA-43) CONTAINMENT OF FRAGMENTS FROM A RUNAWAY REACTOR. Technical Report No. 5. N. B. Botsford, D. D. Keough, and R. W. White (Stanford Research Inst. Poulter Labs., Menlo Park, Calif.). Dec. 2, 1963. Contract AT(04-3)-115. 131p.

The research program on the missile hazard from a reactor excursion was continued. Model firings were carried out which simulated 2-msec excursions. Simulated refueling accidents were also studied. Scaling effects are discussed. The energy source was modified to decrease the amount of damage. (D.L.C.)

9566 (TID-8200(9th Rev.)) NUCLEAR REACTORS BUILT, BEING BUILT, OR PLANNED IN THE UNITED STATES AS OF DECEMBER 31, 1963. (Division of Reactor Development, AEC). 23p.

Information is presented in tabular form on reactors and critical facilities. The information is arranged in five parts: civilian reactors, military reactors, production reactors, reactors for export, and critical assembly facilities. The information includes name, location, designation, type, power, and status. (D.L.C.)

9567 (WAPD-BT-29) BETTIS TECHNICAL REVIEW. REACTOR TECHNOLOGY. (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Oct. 1963. Contract AT-11-1-GEN-14. 90p.

Seven papers are abstracted separately in NSA on reactor technology. (N.W.R.)

For abstracts of individual papers see: 8487, 8710, 8774, 9607, 9653, 9654, and 9655.

9568 SOLUTION OF THE NUCLEAR REACTOR KINETICS EQUATIONS BY A METHOD OF SUCCESSIVE APPROXIMATIONS. A. Belleni-Morante (Universita, Florence). J. Nucl. Energy, Pt. A & B, 17: 439-40(Dec. 1963).

The method of successive approximations is illustrated and shown to converge. The integral form of the reactor kinetics equations is considered. (R.E.U.)

9569 CHEMICAL ENGINEERING TECHNOLOGY OF ORGANIC COOLED NUCLEAR REACTORS. A. L. Kohl and A. M. Stelle (Atomics International, Canoga Park, Calif.). Progr. Nucl. Energy, Ser. IV, 5: 123-41(1963).

The state of chemical engineering technology of organic-cooled power reactors is shown by reviewing the coolant processing systems. The characteristic process systems consist of coolant purification, degasification, and disposal of damaged organic coolant. Purification may employ several general techniques including distillation, adsorption, and filtration to keep the coolant clean and free from film forming contaminants. The techniques are reviewed to show their interrelationship and over-all contribution to prevent fouling of heat transfer surfaces. The degasification system prevents the build-up of water in the process systems, due to possible inleakage from the steam generator, and removes the very volatile decomposition products and gases. The low pressure and spray system is reviewed to show techniques for the recovery of usable coolant as well as the removal of waste products. Since about 27 lb. of high boiler material are formed per megawatt day, large power reactors require an effective means of disposal of both gaseous and liquid decomposition products. Waste gas is held in adsorption columns for decay before release and high boiler material is burned in a heat recovery boiler. The characteristics of these systems are reviewed. (auth)

9570 THE THERMAL REACTIVITY OF NUCLEAR GRADE GRAPHITES TO OXYGEN. J. B. Lewis (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 145-72(1963).

The chemistry of oxidation reactions of graphite moderating materials is discussed. The significance of graphite reactivity on reactor safety is also discussed. 92 references. (R.E.U.)

9571 THE RESPONSE OF CONTAINMENT STRUCTURES TO TRANSIENT PRESSURES CAUSED BY NUCLEAR REACTOR RUNAWAY. Wilfred E. Baker (Aircraft Armaments, Inc., [Cockeysville, Md.]). Progr. Nucl. Energy, Ser. IV, 5: 581-99(1963).

A survey is presented of the effects of transient pressure on the containment of effects from reactor runaway. Various evaluations of specific containment structures are cited and recommendations are made. An approximate criterion for static analysis of the structure is given. A dynamic model law is stated that applies to scale model experiments on response of reactor containment structures to simulated runaway with application to large plastic response. A discussion on underground containment is included. 54 references. (R.E.U.)

9572 STUDIES ON TRANSIENT HEAT TRANSFER IN THE HETEROGENEOUS WATER REACTOR. PART I. Shigenori Hayashi and Akira Sakurai (Kyoto Univ.). Tech. Repts. Eng. Res. Inst., Kyoto Univ., 13: No. 6, 1-21(May 1963). (In Japanese)

When a sudden excess reactivity is introduced into a heterogeneous water reactor, the reactor power increases as an exponential function and the fuel plate temperature rises rapidly. In many reactors, however, the reactor power does not infinitely increase as an exponential function, but self-shutdown is induced by the thermal energy increase in the reactor with increasing reactor power. Finally, the reactor power stops increasing. Experimental and theoretical studies were performed on the transient heat transfer between the fuel and the coolant when the reactor power increased exponentially. Application of these results to analysis of the reactor kinetics during a power excursion is shown. The experiments showed good agreement with the analysis. (auth)

9573 DOPPLER EFFECT IN FAST REACTORS FOR NON UNIFORM HEATING AND TEMPERATURE DISTRIBUTION. Emile A. Fossoul (Argonne National Lab., Ill.). 23p. (CONF-334-16)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

Spatial heterogeneity effects in fast reactors are used to deal with heterogeneity in temperature and in heating by considering a homogeneous mixture of atoms submitted individually to different temperatures and heating laws. (R.E.U.)

Auxiliaries and Components

9574 (BMI-X-10074) A STUDY OF ROTARY-SHAFT-SEALING CONCEPTS FOR PRESSURIZED-WATER REACTOR APPLICATION. Quarterly Progress Report for October–December 1963. C. Malcolm Allen, William G. Rieder, and Daniel R. Grieser (Battelle Memorial Inst., Columbus, Ohio). Jan. 1, 1964. Work Performed under United States–Euratom Joint Research and Development Program. Contract W-7405-eng-92. 25p. (EURAEC-937)

Seals that can be used at 2500 psi and 600°F are being studied. Detailed experimental investigations are made of the mechanical face seal and the packed-gland seal concepts using highly instrumented, moderate-pressure, model seal systems. The major experimental effort in the study of mechanical face seals is directed toward determining the size and shape of the interfacial fluid film in the sealing gap. Observations have revealed microrupture within the fluid of the sealing gap and gross vaporization of the sealed water in the seal region under conditions sufficient for the occurrence of local boiling. Distortions of the sealing interfaces as a result of sealed pressure are revealed. A computer program for the calculation of mechanical face-seal distortion is completed. Studies of packed-gland seal behavior show the development of microruptures, gross vaporization, and mode of failure of a seal system. Water leakage, temperature patterns, and frictional drag of the seal are being studied as a function of various operating modes and parameters. (N.W.R.)

9575 (EURAEC-831) DEVELOPMENT PROGRAM ON THE APPLICATION OF STEAM–WATER SPRAY TO REACTOR COOLING. CAN-3 Quarterly Progress Report No. 7, July 1–September 30, 1963. (Centro Informazioni Studi Esperienze, Milan). Sept. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 056-62-1-RDI. 13p. (CISE-R-85)

Experimental work on the loop for large-scale experiments of heat transfer and hydrodynamics was devoted to tests and measurements with the extraction probe on a circular test element. All the experiments were carried out at a constant pressure (51 kg/cm^2). Pressure drop and heat transfer coefficients were also measured. A test element (G-4) was designed and built to study the influence of the heated length and pressure on critical heat flux, and the effect of a pressure drop at the inlet of the heated channel. Corrosion tests are described. Results of out-of-pile corrosion tests were compared with analogous in-pile results. A static corrosion test was initiated in order to determine the behavior of Zircaloy-2 tabs and rods at 285°C and 70 kg/cm^2 in wet steam. Chemical analysis and radioactive measurements were carried out on some samples of corrosion product collected on filters and resin beds during in-pile corrosion runs. (auth)

9576 (GAMD-4691) COMPARISON OF EXTERNALLY DRIVEN CIRCULATORS WITH THE TURBOCIRCULATOR. J. Yampolsky (General Atomic Div. General Dynamics Corp., San Diego, Calif.). May 7, 1963. Contract AT (04-3)-167. 21p.

Three different ways of pumping the gas between the reactor and the steam generator in gas-cooled reactors are possible: electric motor driving through a fluid coupling; a steam turbine in series with the main steam turbine; and a turbocirculator in which the work results from lowering of the thermodynamic potential of the gas stream. An analysis is presented of the thermodynamic requirements and costs of each of the above ways. (D.L.C.)

9577 (HW-78332) CONTROL ROD CALCULATIONS FOR A PLUTONIUM-FUELED THERMAL REACTOR. P. L. Hofmann and R. H. Holeman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 22, 1963. Contract AT(45-1)-1350. 33p.

Calculations were performed for various Pu cores with a specific configuration and for a comparable U core. The results show that the addition of Pu^{240} decreases control rod worth. A comparison of control rod effectiveness in Pu and U^{235} cores indicates an increase in rod effectiveness in the U core of about 20%. Calculations for a Pu core further showed a slight increase in rod effectiveness with temperature. Both Hf and 1/v absorbers were considered. (D.C.W.)

9578 (IITRI-A6042-3) STUDIES OF REACTOR CONTAINMENT. Bimonthly Progress Report, August-September 1963. E. V. Gallagher (Illinois Inst. of Tech., Chicago. IIT Research Inst.). Contract AT(11-1)-578. 40p.

Progress is reported on crushable shield analysis and design, shock impingement experiments on crushable shields, and coolant decompression experiments and analysis. A description of the various subroutines used in generalized stress wave motion computer code written in the FORTRAN language for the IBM 7090 Computer for calculation of wave transmission in layered composites of materials is given along with their uses. A data acquisition method is described which uses data from successive shock tube loading experiments on one sample to obtain the unloading isentrope relations for balsa wood in the shock tube facility. Information is given regarding the initial stages of vapor formation caused by sudden decompression of water. (N.W.R.)

9579 (NP-12980) REACTOR CONTAINMENT. (American Society of Civil Engineers, New York), comp. Richard J. Smith, ed. (Division of Technical Information Extension, AEC). Nov. 1963. 22p.

A total of 157 references pertaining to reactor containment is presented in five categories of interest: Site Selection and Location, Containment Design Criteria, Dynamics and Missile Effects, Structural and Mechanical Design, and Construction and Testing. Covering the period from 1949 through 1962, the references were selected on the basis of usefulness to the Civil Engineer. The bibliographic sources used are listed, and should be consulted for additional information in progress reports and general papers. An author index is provided. (auth)

9580 (WAPD-T-1632) NON-ASYMPTOTIC LATTICE PARAMETERS IN A DRY UO_2 BLANKET–MEASUREMENTS AND CALCULATIONS. J. Korsmeyer, C. Emert, P. Johnson, S. Milani, J. Mitchell, R. Serenka, and S. Weiss (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Sept. 1963. Contract AT(11-1)-Gen-14. 19p. (CONF-187-47)

From American Nuclear Society Meeting, New York, Nov. 1963.

The ratios of epicadmium to subcadmium capture in U^{238}, of U^{238} capture to U^{235} fission, of U^{238} fission to U^{235} fission, and of epicadmium to subcadmium fission in U^{235} were measured in a UO_2 blanket in a UO_2-Zr-H_2O seed blanket-seed slab core with a water to nonwater volume ratio of 0.142. The results were compared with calculations by a design model using a one-dimensional few group diffusion program and with calculations by a one-dimensional, multigroup P-3 transport code. (D.C.W.)

9581 (WCAP-2347) SODIUM PUMP DEVELOPMENT AND PUMP TEST FACILITY DESIGN. (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Aug. 1963. Contract AT(30-1)-3123. 169p.

The study defines a program for the development of large sodium pumps for use with sodium cooled reactor systems of 1000 to 1500 Mw(e) capability, and the functional requirements of a related sodium pump test facility for testing large pumps. The future pump requirements of large power systems have been estimated, a type of sodium pump recommended for further development, the development problems identified and a program research and development prepared to resolve these problems. The functional requirements of a sodium pump test facility for testing pumps for large reactor use have been established. (auth)

9582 A GROSS GASEOUS PARTICULATE FISSION PRODUCT MONITORING SYSTEM. F. W. Boone (Aerojet-General Nucleonics, San Ramon, Calif.). Am. Ind. Hyg. Assoc. J., 24: 611-17(Nov.-Dec. 1963).

In the operation of a nuclear reactor it is essential to continuously determine the rate of leakage of fission products from the reactor core into the primary coolant stream. Unfortunately, due to the mode of generation and release of fission products, the complex nature of their gross decay and their varied physical and chemical characteristics, standard monitoring equipment, techniques and analytical procedures are inadequate. In this article a unique method is described for continuously determining the fission product release rate from an open cycle gas cooled reactor as well as the methods of calibration analysis. (auth)

9583 SEAL-LESS MECHANICAL POWER TRANSMISSION FOR REACTOR HANDLING ELEMENTS. O. Bobleter (Osterreichische Hochschule, Vienna). Atomwirtschaft, 8: 655-6(Dec. 1963). (In German)

Power transmission into fully sealed systems is necessary in many technical fields. This problem is particularly pressing in the case of power reactors, which are operated with costly resources such as heavy water or helium. The solution was found in a power transmission system using components of highly elastic, steel, pressure tubes, which are used in place of the corrugated tubes. In the experimental investigation of the device a special steel of 10 mm diameter, 2 mm wall thickness, and 700 mm length was used as the elastic tube. In order to distribute the flexing over the whole length of the tube and, at the same time, to avoid the danger of metal fatigue the wall thickness of the elastic tube was reduced towards the outside of the system. Life tests showed the superiority of this arrangement over one using corrugated tubes. (auth)

9584 THE INFLUENCE OF CHEMICAL PURITY ON THE NUCLEAR PROPERTIES OF GRAPHITE. J. Rappeneau and M. Yvars (CEN, Saclay, France). Energie Nucl., 5: 512-25(Nov. 1963). (In French)

The use of artificial graphite as a moderator in nuclear reactors is interesting because of its weak neutron capture cross section. In spite of the high preparation temperatures, it contains trace impurities that can considerably increase the capture cross section of graphite. The determination procedures used for the following elements are described: B, Cl, H, Na, K, Li, Mg, V, Fe, Mo, Ti, and Si. The methods used to determine the concentrations of certain rare earths (Dy, Eu, and Sm) are also indicated. These analytic methods are used in order to follow the production of graphite destined for the G1, G2, G3, EDF1, and EDF2 reactors. The principal correlations which exist between the capture cross section and the concentrations of certain elements were pointed out. The influence of the quality of the raw materials used in the manufacture of graphite as well as the efficiency of the purification processes was underlined. Some applications of these determination procedures are given in examples, such as: examination of the pollution in the channels of the G1 reactor and of the longitudinal and radial distribution of the impurities in a graphite rod, and estimation of the capture cross section of carbon. (auth)

9585 EXPANSION AND TENSION MEASUREMENTS ON A MODEL OF A PRESSURIZED-WATER REACTOR. H. Wolf (Siemens-Schuckert-Werke AG, Mulheim, Ger.). Schweiz. Arch. Angew. Wiss. Tech., 29: 201-11(June 1963). (In German)

The strength calculations for pressure vessels of pressurized-water reactors are prepared often with considerable difficulty. For many parts of these pressure vessels calculations are not accessible owing to their com-

plicated form or are limited in range. An experimental tension analysis on a model or later on the original, as a basis or supplement for calculations, was therefore, recommended in each case. Various expansion and tension measurements on a model of a pressurized-water reactor are described. (M.C.G.)

9586 VOPROSY FIZIKI ZASHCHITY REAKTOROV. (Problems in Reactor Shielding Physics). D. L. Brodera, A. P. Veselkina, Yu. A. Egorova, V. V. Orlova, and S. G. Tsypina, eds. Moscow, Gosatomizdat, 1963. 348p.

Results from forty-two experimental and theoretical studies of biological protection against nuclear reactor emissions are included. Space-energy and angular distributions of emissions and radiation penetration through homogeneous and heterogeneous shielding are analyzed. Descriptions are given of various devices for determining the flux and spectral distributions of radiation behind and within shielding. (R.V.J.)

9587 IMPROVEMENTS IN AND RELATING TO CHARGING ARRANGEMENTS FOR PRESSURISED GAS-COOLED NUCLEAR REACTORS. David John Ingram and James Harry Steen (to General Electric Co.). British Patent 946,803. Jan. 15, 1964. Filed May 24, 1961.

Charging arrangements for pressurized gas-cooled nuclear reactors are described. An improved facility for the rehearsal operation is provided. It consists of an auxiliary pressure vessel mounted outside the main pressure vessel of the reactor that houses a dummy charge face and dummy fuel channel. The auxiliary pressure vessel is adapted to be connected to the charge machine and is connected in a branch circuit to the main hot gas flow circuit of the reactor so that the temperature and pressure conditions within the auxiliary pressure vessel substantially correspond to the temperature and pressure conditions in the reactor. (M.C.G.)

9588 IMPROVEMENTS RELATING TO FUEL ELEMENT DISCHARGING DEVICES IN NUCLEAR REACTORS. (to Commissariat à l'Énergie Atomique). First Add. No. 73,194 to French Patent 1,129,103. Sept. 23, 1960. Filed Mar. 12, 1958.

A fuel element discharging device for a power reactor having a large number of horizontal reactor channels is described. This device comprises a series of sloping chutes into which the fuel elements to be discharged are pushed, and a brake device with helical ducts through which these fuel elements pass and in which their movement is braked so as to obtain a limited velocity. According to this addition, the device is constructed in such a way that it can be used for pressurized reactors during their operation. Therefore a collecting chamber is provided into which the fuel elements coming from the brake device enter via several ducts, as well as a gas-lock chamber receiving the fuel elements via a valve from the collecting chamber, while appropriated convexing means are provided for controlling the transfer of the fuel elements within the chambers. This convexing means is suitably of an electromagnetic vibrating type. The lock chamber serves for the transfer of the elements to the atmospheric pressure, while both the collecting and the lock chamber form a part of a closed circuit for cooling the fuel elements during their passage. (IIB)

9589 OPERATING PROCESS FOR A NUCLEAR REACTOR AND DEVICE FOR PERFORMING THIS PROCESS. (to Beteiligungs- und Patentverwaltungs GmbH and Brown, Boveri & Cie AG). French Patent 1,289,985. Feb. 26, 1962. Priority date May 25, 1960, Germany.

For a reactor with a core formed by loosely packed spherical fuel elements, a system of circulation of these elements is provided so that the elements coming out of the core are examined for their burnup conditions. The burned-up fuel elements are eliminated from the circuit, while the others are stored afterwards to be sorted according to their burnup conditions. Then these latter fuel elements are reloaded to the reactor core eventually mixed with new elements. The device for performing this operating process comprises means for discharging a certain quantity of these fuel elements at the bottom of the core, which afterwards pass one by one through an articulated tube mounted in an instrument that is adapted for measuring the gamma activity of the elements and for controlling the position of the articulated tube according to the measured intensity. At each of its stationary positions, corresponding to a given activity class, the articulated tube is in alignment with one of a series of storage tubes ending in a common charging tube at the top of the core, each storage tube being provided with an individual mechanism for moving the elements stored within. (IIB)

9590 PROCESS AND DEVICE FOR CONTROLLING A NUCLEAR REACTOR. (to Milhoud et Cie). French Patent 1,298,516. June 4, 1962. Filed June 2, 1961.

In order to control the reactivity of a nuclear reactor, the coolant emerging from the reactor is led through a flattened pipe of rectangular cross section placed between the pole faces of an electromagnet, with electrodes provided within the pipe on the smaller faces perpendicular to the pole faces. The ionized coolant passing through the magnetic field produces a voltage between the electrodes. By changing the load characteristics of the electric generator formed in this way, the dynamic and thermodynamic conditions in the cooling circuit may be influenced so as to influence the reactivity via its coefficients of pressure and temperature. Preferably the device comprises an evacuated chamber disposed in the immediate proximity of the reactor coolant exit, enclosing several branch ducts through which the coolant flows. The branch ducts, which are interconnected at their ends, are each provided with one of the electric generators. (IIB)

9591 REMOTE CONTROLLED WATER-AIR LOCK CHAMBER. (to Commissariat à l'Énergie Atomique). French Patent 1,299,705. June 18, 1962. Filed June 16, 1961.

A lock chamber for the transfer of objects from the pool of a reactor to a treatment or observation chamber adjacent to the pool comprises a cylindrical chamber forming a hole in the shielding wall of the reactor pool and remotely controlled doors adapted to close the two extremities of this chamber. The door control mechanism has a control shaft passing through the shielding wall of the observation chamber and being provided with a handwheel and at its other extremity with a pinion of a gear-box that can alternately be coupled with the individual control mechanisms of one of the doors, this coupling being performed by an axial movement of the control shaft. The lock-chamber is further provided with means for preventing the simultaneous opening of both doors. (IIB)

9592 DEVICE FOR CLOSING THE BOTTOM HOLES OF THE TANK OF A NUCLEAR REACTOR. (to Groupement Atomique Alsacienne Atlantique (G.A.A.A.)). French Patent 1,305,489. Aug. 27, 1962. Filed Aug. 7, 1961.

In heavy-water-moderated reactors, the reactor tank is often provided with a plurality of holes serving as passages for the heavy water circulation. According to the position

of the fuel elements within the tank it is necessary to close some of these holes with the possibility of reopening them. The closing device comprises a hollow aluminum capsule as a closing plug. Within its cavity, a device is arranged adapted to lock the plug in the hole to be closed and to couple it with the head of handling means controlling the position of the locking device. The locking device preferably consists of a cold drawn corrugated aluminum strip such as to form a compression spring whose ends laterally pass through openings in the capsule and engage in grooves provided in the wall of the hole to be closed. For unlocking, the cylindrical end of the handling means engages with its bevelled edge over the corrugations of the locking spring in order to compress it and to make it retract its ends from the grooves. (IIB)

9593 PROCESS FOR CHARGING AND DISCHARGING A NUCLEAR REACTOR. (to Électricité de France). French Patent 1,306,711. Sept. 10, 1962. Filed Sept. 6, 1961.

A permutation of fuel elements is performed so as to eliminate burned-up fuel elements, and to reintroduce those, called half burned-up, that were exposed to a lower neutron flux. A storage spot is provided for the half burned-up fuel elements while in a same cycle two adjacent channels are deserved so that the discharging of the burned-up fuel elements from one channel and the charging of new elements into the other one are performed by the same to-and-fro movement of the handling means. Suitably the half burned-up fuel elements discharging at one charging cycle from one end of a given channel are stored and at the following charging cycle re-introduced at the opposite end of the same channel. According to another variant of the process the half burned-up elements are reintroduced without any storage in the opposite end of the adjacent channel that is otherwise reloaded with new fuel elements. Preferably a group of channels is deserved by the same machine, the central channel of the group serving as a storage spot. (IIB)

9594 IMPROVEMENTS RELATING TO NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). French Patent 1,307,044. Sept. 10, 1962. Priority date Sept. 28, 1960, Great Britain.

A core is described comprising a series of regions at least one of which is movable between an active position in which it fits in the remaining core and an inactive position in which the core is subcritical. For shutting down the reactor this movable region is quickly moved from the active to the inactive position. More generally, all the regions of the reactor are independently supported. A movement of the corresponding supports brings said regions from the active into the inactive position and vice-versa. Preferably this movement consists in a translation in order to separate the corresponding region from the core and a succeeding rotation in order to bring it into a position in alignment with the charging and discharging facilities. (IIB)

9595 NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). French Patent 1,307,589. Sept. 17, 1962. Priority date Jan. 23, 1961, Great Britain.

A reactor is known comprising a series of vertical channels each loaded with a pile of fuel elements, some of which are provided with thermocouple junctions connected with the outside of the reactor via conductors disposed in the fuel elements arranged above the thermocouple fuel element. A telescopic thermocouple rod, placed at the upper end of the channel serves for the connection of all the thermocouples with the outside. An auxiliary thermocouple junction is provided on the telescopic rod for measuring the coolant exit temperature at the charging face of the reactor core. In a first embodiment the latter junction is fixed on the outer surface of the rod, while in another embodiment this junction is supported at a distance from the rod surface either outside the rod or within the hollow rod. The junction may also be shielded from thermal radiation. (IIB)

9596 IMPROVEMENTS RELATING TO NUCLEAR REACTORS AND TO METHODS OF VARIATION OF THEIR REACTIVITY. (to General Nuclear Engineering Corp.). French Patent 1,310,151. Oct. 15, 1962. Priority date Dec. 15, 1960, United States.

A reactor comprising a series of vertically extending core regions, each comprising means for varying its reactivity, is described. These means comprise a vertical channel passing through the region, and poisoning elements adapted to be moved from a position within the core to a position within an upper extension of the channel outside the core, and vice versa. An upstream fluid flow within the channel is controlled, so that at a high fluid flow the poisoned elements are held within the upper extension and at a reduced flow intensity the poisoning elements fall down into the core in order to reduce the reactivity there. Preferably the poisoning elements are balls enclosing a neutron absorber. According to another embodiment the poisoning elements form a series of telescopic tubes sliding one within another, the inner tube being closed at its bottom. (IIB)

9597 IMPROVEMENTS RELATING TO HANDLING DEVICES FOR ABSORBER ELEMENTS IN A NUCLEAR REACTOR. (to Commissariat à l'Énergie Atomique). French Patent 1,311,324. Oct. 29, 1962. Filed Oct. 24, 1961.

An arrangement in which the absorber elements are introduced into the reactor from beneath comprises a rod fixed to the absorber element able to slide within a vertical channel. The lower end of this rod is fixed to a flexible member, e.g., a cable with one end controlled by a winch. The other end, running over a fixed pulley, is connected to a counterweight. The arrangement is such that when the winch is decoupled from its drive motor, the counterweight provokes a rapid introduction of the absorber element into the reactor. Preferably the absorber element consists of a curved plate introduced into a corresponding cavity provided within the reflector. (IIB)

9598 METHOD FOR DETECTING FISSION PRODUCT ESCAPES IN A NUCLEAR REACTOR. (to United Kingdom Atomic Energy Authority). French Patent 1,313,498. Nov. 19, 1962. Priority date Feb. 2, 1961, Great Britain.

A method for detecting fission product escapes due to burst fuel elements in a nuclear reactor or due to burst sealed fuel samples in an experimental loop of the reactor consists of separating a sample from the cooling fluid in contact with the mentioned sources of fission product escapes and measuring the beta activity of the sample in the range of 1.5 to 6 Mev. Such a measurement allows the fission product activity to be distinguished from the activity of the cooling fluid, so that, e.g., the presence of fission products is evident if after ten minutes the activity is slowed to at least half. (IIB)

9599 DECAY HEAT REMOVAL SYSTEM FOR LIQUID-COOLED NUCLEAR REACTORS. Thomas Deighton (to Babcock and Wilcox Ltd.). German Patent 1,156,516. Oct. 31, 1963. Priority date Jan. 20, 1960, Great Britain.

The nuclear reactor described is provided with a closed primary main circuit for the generation of power and a separate closed emergency circuit for the dissipation of reactor decay heat. The emergency circuit comprises a pressurizer disposed above the level of the core structur an emergency heat exchanger, and valved ducting connecting the pressurizer, and the emergency heat exchanger in a closed circuit with the core structure. The pressurizer is provided with an overflow pipe so that natural circulation is established in the emergency circuit on cessation of normal coolant circulation because of a volume expansion of the reactor coolant. (Gmelin Inst.)

9600 ROTARY SELECTOR PERMITTING VARIABLE COMMUNICATIONS TO BE ESTABLISHED BETWEEN AN ASSEMBLY OF PASSAGEWAYS TRAVERSED BY A FLUID. René Donguy, André Roguin, and Jean Megy (to Commissariat a l'Energie Atomique). U. S. Patent 3,116,757. Jan. 7, 1964. Priority date June 4, 1959, France.

A rotary selector was designed to permit variable communications to be established between an assembly of passageways traversed by a fluid. The selector is used to determine which channel is being traversed by a fluid charged with radioactive products escaping from the core of fuel elements during fission of their casing. The rotary selector valve consists of a stationary valve casing, an internal chamber in the casing, a base fixed to the casing, a plurality of first ports in the member spaced at predetermined angular distance with two of the ports spaced at a multiple of this distance about a circle centered on the axis, a plurality of fluid conduits, a plate rotatably mounted about the axis, a plurality of second ports in the plate for registration with the first ports, a plurality of closures carried by the plate between the second ports for closing the first ports, and a control device for step-by-step rotation of the plate in either direction in steps equal to the angular distance between two adjacent closures. (M.C.G.)

Crititicality Studies

9601 (ANL-6691) CRITICAL EXPERIMENT WITH BORAX-V. Internal Superheater. K. E. Plumlee, Q. L. Baird, G. S. Stanford (Argonne National Lab., Ill.); and P. I. Amundson (Argonne National Lab., Idaho Falls, Idaho). Nov. 1963. Contract W-31-109-eng-38. 36p.

A critical experiment was performed with 12 BORAX-V superheater subassemblies in a central voidable region plus 1228 to 1525 UO_2 fuel pins (3 wt % enriched) in a peripheral region. Removing water (28% of superheater volume) at room temperature decreased reactivity by 2.2%. The midplane (two-dimensional) peak-to-average power distribution in the voided superheater was approximately 1.24, mostly attributable to flux depressions within insulated fuel boxes. Cadmium ratios are also reported. The experiment was initiated to supplement computational information which might have affected plans for loading the superheater zone into the BORAX-V reactor. No changes were indicated by the experiment. (auth)

9602 (GEAP-4420) INFLUENCE OF THE DOPPLER EFFECT ON THE MELTDOWN ACCIDENT. B. Wolfe, N. Friedman, and D. Riley (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Nov. 18, 1963. Contract AT(04-3)-189. 26p.

The influence of the Doppler effect in the core disassembly process following a meltdown accident is examined with a Bethe-Tait type model in which the Doppler effect, as well as core disassembly, is considered in the reactor shutdown process. It is shown that a strong negative Doppler effect can radically reduce the explosive energy release in such an accident. (auth)

9603 (HW-77147) APPROXIMATE METHOD FOR ANALYZING A SELF-LIMITING REACTOR TRANSIENT. W. K. Winegardner (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 27, 1963. Contract AT(45-1)-1350. 27p.

The neutron kinetics and heat transfer equations required to describe the transient response of an excursion are given, and the results of analog computer studies of transients in the Plutonium Recycle Critical Facility using these equations are presented. The reactor core configuration is described, and the equations used to describe the reactivity feedback mechanisms of the core are included. (auth)

9604 (MND-MD-2545) PM RESEARCH AND DEVELOPMENT PROGRAM — PM CORE 2 CRITICAL EXPERIMENTS. H. B. Rosenthal (Martin-Marietta Corp. Aerospace Div., Baltimore). Dec. 1963. Contract AT (30-1)-2706. 79p.

A description is given of a series of critical experiments performed on a mockup of PM Core 2, the second generation core for the PM-1 and PM-3A nuclear power plants. The experimental facility, hardware, and measurement techniques are described. Initial evaluations to ascertain control system shutdown margin with one control rod fully withdrawn resulted in a core configuration modification to enhance the shutdown margin. Experiments performed on the modified (final design) configuration included core reactivity measurement, control system studies, power distribution measurements, and determination of temperature coefficient of reactivity. Significant results are:

Total core reactivity (20°C)	10.65% Δk/k
Critical control rod bank position	9.06 in. withdrawn
Maximum peak-to-average power ratio	3.07
Maximum peak-to-average power ratio for a fuel tube	1.37
Temperature coefficient of reactivity (20°C)	-0.83×10^{-4} ρ/°C

The shutdown margin with one control rod fully withdrawn was determined to be 1.91% Δk/k at 20°C. (auth)

9605 (TRG-Report-602) A GENERAL STUDY OF TRANSIENTS DUE TO REACTIVITY INSERTIONS IN FAST REACTORS HAVING A LOW-TEMPERATURE FUEL. R. K. Thomasson (United Kingdom Atomic Energy Authority. Reactor Group, Dounreay, Caithness, Scotland). July 31, 1963. 62p.

The conditions for dynamical similarity in the response of fast reactors to reactivity disturbances are determined. The parameter variations investigated are coolant flow and the relative proportions of various types of reactivity feedback. Rather than record transients for each set of parameters, the range of parameter variation for which temperatures can be conservatively calculated on a steady-state basis is determined. For the transients investigated (steps and ramps applied at very low powers) it is shown that, even when the core feedback contains a fast-acting positive term, very large steps of reactivity can usually be applied without causing overshoots in temperature. A relation between the step size and the ramp rate that just fails to cause an overshoot is shown to exist. The relation is substantially independent of the form of the feedback. A method using the results of the study for determining the maximum safe rates of reactivity additions when starting

up a reactor is described. The safety implications of a positive sodium coefficient and the probable effects on the kinetics of using a high-temperature fuel are discussed. (auth)

9606 (TRG-Report-648) AN AUTOCODE PROGRAMME TO CALCULATE THE FAST-TO-THERMAL FLUX RATIO ON THE AXIS OF ARRAYS OF CONCENTRIC FISSILE CYLINDERS. J. Griffiths (United Kingdom Atomic Energy Authority. Reactor Group, Dounreay, Caithness, Scotland). Oct. 3, 1963. 7p.

A program for calculating fast-to-thermal flux ratios on the axis of fissile cylinders is described. The calculation takes into account the presence of moderating material inside the cylinders and in particular calculates the ratio when a void, graphite, H_2O, or D_2O are present inside the cylinders. (auth)

9607 (WAPD-BT-29(p.19-27)) SAFE-1—A COMPUTER PROGRAM FOR NUCLEAR SAFETY CRITICALITY CALCULATIONS. R. E. Kropp (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Bettis program SAFE-1 is developed to calculate the criticality of individual cylindrical, spherical, or rectangular reactors. This FORTRAN program calculates the moderation ratio of the reactor plus diffusion constant, macroscopic cross sections, eigenvalues, and flux ratios for four energy groups. The required input and equations used are discussed. (auth)

9608 MULTIREGION REACTOR KINETICS EQUATIONS BASED ON REGION FLUXES. Isao Iyori (Transportation Technical Research Inst., Tokyo). Rept. Transport. Tech. Res. Inst. (Tokyo), No. 58, 1-24(Mar. 1963).

Multiregion reactor kinetics is studied on the assumption that the critical flux can be decomposed into a set of fluxes each of which corresponds to one region of the reactor (region fluxes). The principal objective is to find the region fluxes that result in the best kinetics equations for the multiregion reactor perturbed over a specified region. One of the advantages of this method is that even for the perturbation which excites several higher-mode fluxes this method gives a good approximation without increasing the dimension of the kinetics equations. Another advantage is the elimination of the eigenvalue problems for the higher-mode fluxes of the unperturbed reactor. Numerical calculations on fictitious two-region reactors show that this method of analysis is encouraging. (auth)

9609 MINIMIZATION OF REACTOR NOISE THROUGH MINIMUM BANDWIDTH CONTROL. Lynn E. Weaver and Hugh S. Murray (Univ. of Arizona, Tucson). 24p. (CONF-332-5)

From Symposium on Noise Analysis in Nuclear Systems, Gainesville, Fla., Nov. 1963.

It is shown that the minimum bandwidth design technique has a marked effect on reducing the reactor noise output and increasing system stability. The designed system response to a step change in reactivity and in power demand was a major improvement over the design based on minimization of reactor noise output subject to a saturation constraint on the control rod drive mechanism. In the example presented, the uncompensated reactor transfer function was second order. (C.E.S.)

Design and Feasibility

9610 METHODS FOR CALCULATING THE RADIATIVE HEAT RELEASE IN THE REACTOR VESSEL AND SHIELD. D. L. Broder and K. K. Popkov. At. Energ. (USSR), 15: 370-7(Nov. 1963). (In Russian)

Absorption of neutron and γ radiation causes the heating of the reactor vessel and shield placed within the radiation field. In some reactors the flux incident on the vessel may reach 10^{13} to 10^{14} neutron/cm^2 sec and therefore the specific heat release could amount to several watts per cm^3 and in the shield directly adjoining the vessel it may approach 10^2 watt/cm^3. The heavy-walled vessels designed to withstand pressures of the order of 100 atm may be subjected to serious, radiation-heat-generated stresses which must be taken into account when calculating the strength of the system. The most important sources of heat generation are: γ radiation from the fission products; radiative capture in the structural and shielding materials; and the $B^{10}(n,\alpha)Li^7$ reaction for B-containing materials. The γ radiation due to inelastic scattering of fast neutrons and the energy losses by the elastic scattering of neutrons on the relatively heavy Fe and Ni nuclei may be neglected. Thus simplified, the heat generated Q may be expressed as the sum of 2 components, depending on the absorption of γ radiation and the α particles, in the expression: $Q = Q_\gamma + Q_\alpha$ watt/cm^3. A computational method was developed for calculating these components. The distribution of radiative capture sources in a steel shield surrounded by a moderator is expressed by 2 exponents. While calculating the heat generated by the absorption of α particles, the simultaneously emitted 0.478 γ quantum must also be taken into consideration. (TTT)

9611 KONSTRUKTIVNYE FORMY I METODY RASCHETA KONSTRUKTSII YADERNYKH REAKTOROV. (Design and Calculations for Nuclear Reactor Construction). N. P. Mel'nikov. Moscow, Gosatomizdat, 1963. 520p.

Technical and economic problems in reactor construction are analyzed, and theoretical data on reactor design and construction are reviewed. Various phases and tendencies in reactor construction, based on experimental and theoretical data, are considered. (R.V.J.)

9612 NUCLEAR REACTOR WITH FIXED BED FUEL ELEMENTS. (to Centro Informazioni Studi Esperienze). British Patent 946,901. Jan. 15, 1964. Priority date Jan. 14, 1961, Italy.

A reactor is described in which the fuel elements consist of cylindrical tubes containing a fixed bed of uranium dioxide fuel granules. The tubes have holes in their walls and are vertically arranged in the core of the reactor. The fuel tubes are immersed in a coolant liquid (water) that enters the core of the reactor at the lower ends of the fuel elements and leaves at the upper ends. (M.C.G.)

Fuels

Refer also to abstracts 8715 and 8720.

9613 (DPST-63-69-11) EFFECT OF ROD SPACING ON HEAT TRANSFER BURNOUT. USAEC-AECL Cooperative Program Monthly Progress Report, October 1963. R. H. Towell (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Dec. 1963. Contract AT(07-2)-1. 7p.

The surrounding-rod mockup was loaded in the pressure shell and prepared for hydrostatic testing. The Kanigen plate on the star-shaped channel appeared to be satisfactory. The preliminary shakedown tests with the annular housing tube were concluded. To minimize the bowing of the central rod observed during the shakedown tests, the distance between the sapphire spacer pins was reduced to 6 inches. (auth)

9614 (DPST-63-69-12) EFFECT OF ROD SPACING ON HEAT TRANSFER BURNOUT. USAEC-AECL Cooperative Program Monthly Progress Report, November 1963. R. H. Towell (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Dec. 1963. Contract AT(07-2)-1. 5p.

The Chromalox heaters were operated on the 300-kw-AC power supply for the first time. The power test was interrupted by an electrical arc between the connecting pin and the sheath of one of the heaters. The damage was slight and a number of equipment modifications are being made to prevent recurrence. Hydrostatic testing of the star test section to assure safe operation at 1000 psia was completed. Two equipment modifications were required to correct defects noted during the pressure tests. (auth)

9615 (HW-78388(p.3.1-15)) ANALYTICAL STUDIES AND ADVANCED CONCEPTS. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Computer studies indicated that plutonium-enriched U^{238} or Th^{232} oxide fuels that have sufficient Pu^{240} concentration will not suffer an economic disadvantage when U^{238} is replaced with alloying or diluent materials. A reduced spatial concentration fuel containing U^{238} and Th^{232} enriched with plutonium was studied to determine fuel cycle costs and reactivity response characteristics. Costs for thermal energy supplied to a desalinization plant were determined for two reactor sizes, 3500 and 8300 Mw(e). Fuel cycle costs, reactivity, conversion ratio, and breeding ratio calculations were made for a revised 300 Mw(e) fast reactor using supercritical-pressure water as the coolant. (M.C.G.)

9616 (KR-61) THE EFFECT ON OSCILLATION INDUCED BURN-OUT OF FUEL TIME CONSTANT. H. Christensen and C. Holmsen (Norway. Institutt for Atomenergi, Kjeller). Dec. 1963. 26p.

The inlet flow to a coolant channel is assumed to oscillate with a certain frequency, causing the evaporative cooling to break down repeatedly for a certain fraction of each cycle, at a particular point of the heating surface. For certain idealized conditions, an investigation was conducted of the values of the parameters for which the fuel center temperature peaks above a certain limit. The calculations were carried out on an analogue computer. For typical BWR conditions, parameters such as oscillation frequency, fuel time constant, and the time fraction per cycle with no cooling, have been varied. The results are presented and discussed. It is shown that tests of oscillation-induced burnout in loops give results that are on the "safe side" as compared to reactor fuel elements exposed to the same surface heat flux at the exact same hydraulic condition. (auth)

9617 (NYO-9991) EURATOM REACTOR FUEL MANAGEMENT PROGRAM. PART II. PHYSICS ANALYSIS. (Jackson and Moreland, Inc., Boston and Allis-Chalmers Mfg. Co., Milwaukee). Jan. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2875. (EURAEC-803(Pt.II)). 224p.

Physics analysis was carried out to determine the effects of fuel management in the SENN reactor. Nuclear constants were generated, and published data on the SENN core were analyzed. Varying enrichments were studied for their effects on reactivity, neutron spectrum, and effective constants. The burnup effects over the range of enrichments were determined in terms of reactivity and fuel composition. Radial and axial fuel programing were analyzed for their effects on power distribution and fuel lifetime. Means of increasing the neutron flux in the boiling region are discussed. (D.L.C.)

9618 (ORNL-3501) FUEL CYCLE COSTS FOR A PLUTONIUM RECYCLE SYSTEM. F. E. Harrington, E. D. Arnold, D. C. Brater, D. A. Douglas, S. H. Smiley, W. G. Stockdale, J. W. Ullmann, and A. L. Lotts (Oak Ridge National Lab., Tenn. and Oak Ridge Gaseous Diffusion Plant, Tenn.). Jan. 20, 1964. Contract W-7405-eng-26. 37p.

The costs of the chemical and metallurgical steps in the fuel cycle for large desalination reactors are estimated. Both capital and operating costs are presented at varying plant capacities for a Zircaloy-clad fuel element containing depleted uranium and recycled plutonium as the oxides: UO_2–0.5% PuO_2. The chemical steps are reported at throughputs of 1, 10, and 30 short tons of uranium per day; and the metallurgical or fabrication step at throughputs of 1, 3, 5, and 10 tons per day, as specified by the Office of Science and Technology. The total estimated cost of all the chemical and metallurgical steps drops from $51.17 to $14.68 per kilogram of uranium as the cycle throughput is increased from 1 to 10 tons of uranium per day. All steps decrease in cost as plant capacity is increased, with the most impressive decrease in the irradiated assembly processing step, which decreases from $26.19 to $4.10 to $2.07 per kilogram of uranium as throughput is changed from 1 to 10 to 30 tons of uranium per day. The contained data in conjunction with previous studies of a natural uranium fuel cycle and results of a current reactor optimization study will yield complete fuel cycle costs and plutonium value in recycle. (auth)

9619 (SC-DC-3553(p.295-327)) RE-ENTRY BURNUP ENHANCEMENT OF HYDRIDED ZIRCONIUM–URANIUM ALLOY FUEL. E. L. Foster, Jr. (Battelle Memorial Inst., Columbus, Ohio).

The feasibility of changing the properties of the ZrH–uranium fuel by use of certain additions in a way that will enhance the atmospheric burnup upon reentry from orbit was investigated. The effects of additions to the fuel, particularly those that could produce smaller droplet sizes during its reentry melting, were investigated by analytical and experimental methods. Thirty-eight different modified fuel compositions were prepared. Selections of the type and quantity of alloying additions to be made were based on the effect of the addition on the thermal-neutron cross section of the alloy, on the alloy's melting point and on the mixed oxide's melting points, on the difficulties in making the additions, and on the cost and availability of the additions. Some of the alloying additions caused significant changes in the properties and fabrication characteristics of the fuel (hardness, grain size, melting, casting, rolling, hydriding, and machining). Certain elemental additions improved properties while others caused a deterioration in properties. The majority of the alloys, however, were readily fabricable. A castability test was developed to measure the effect of alloying additions on the surface tension and viscosity of the unhydrided fuel alloy. A significant modification in the fabrication technique was used in the preparation of fuel-rod samples containing additions of oxygen, nitrogen, and carbon. These samples were produced by isostatically pressing powders of zirconium hydride and compounds of uranium at high temperatures. After various modifications were made and instrumentation added to the rocket test facility, no problems were encountered in performing tests. Excellent control and duplication of test conditions were achieved. In tests, no one modified

fuel alloy showed any significant increase in ablation that could definitely be attributable to a change in melting point or fluidity over that of the base alloy. Specimens of 12 different modifications of the reference fuel exhibited ablation losses about the same as the reference fuel. These modifications contained additions of vanadium, tungsten, tantalum, aluminum, bismuth, antimony, strontium, silicon, tin and niobium, oxygen, nitrogen, and carbon. Of the group of materials that ablated with weight losses of about the same magnitude as that of the unmodified fuel, five definitely lost appreciable quantities by fracturing caused by thermal shock. Three of these materials, containing oxygen, nitrogen, and carbon (all fabricated by isostatic compaction), were fractured early in the test and little ablation occurred. The modified alloys containing 5 weight-percent antimony and 2 weight-percent tin/2 weight-percent niobium also lost significant weight through fracture. However, in the evaluation of these materials, significant ablation was noted. Moreover, close examination of the remaining portion of the antimony-containing material suggested that a significantly different manner of ablation might have occurred with this specimen. Under the test conditions which were imposed, the products of ablation were definitely molten. This was confirmed in detailed examination of the test products. The typical products of the rocket-exhaust ablation tests were particles that ranged in size from less than 1 to 5000 microns. The volume distribution of particles was bimodule, suggesting that two primary ablation processes were occurring. It is concluded that the ablation characteristics of the hydride fuel can be changed. (auth)

9620 (SC-DC-3553(p.329-50)) RE-ENTRY OF FUELED GRAPHITE PARTICLES. J. M. Bridges and H. G. Hargrove (Westinghouse Electric Corp. Astronuclear Lab., Pittsburgh).

Analytical and experimental studies of burnup of fueled graphite fragments during reentry are evaluated. (R.E.U.)

9621 (TRG-Report-587) THE ELASTO-PLASTIC THERMAL BOWING OF SOME EXPERIMENTAL NUCLEAR FUEL PINS FOR ADVANCED GAS-COOLED REACTORS. L. R. T. Gardner and D. Fenna (United Kingdom Atomic Energy Authority. Reactor Group, Springfields, Lancs, England). July 22, 1963. 13p.

A recently developed general analysis is applied to discuss the bowing characteristics of 40-in. long fuel pins. Values for maximum bow and loads upon the anti-bowing grids and end support plates are found for the elastic period at the beginning of "in-pile" life and after stresses have relaxed. The bow imparted to the pin if the deformation is completely plastic is also calculated. Finally the shapes of the pin on withdrawal from the temperature field and also from the anti-bowing grids are determined. (auth)

9622 (TRG-Report-596) THE ELASTOPLASTIC THERMAL BOWING OF NUCLEAR FUEL PINS. APPROXIMATE EQUATIONS FOR THE RAPID CALCULATION OF BOWING CHARACTERISTICS OF PINS RESTRAINED BY TWO ANTI-BOWING GRIDS. L. R. T. Gardner and D. Fenna (United Kingdom Atomic Energy Authority. Reactor Group, Springfields, Lancs, England). July 24, 1963. 14p.

Certain approximations are introduced into a recently developed general theory of the thermal bowing of nuclear fuel pins restrained by two equally spaced anti-bowing grids. It is shown that simple expressions may be obtained for the maximum bow of a fuel pin under elasto-plastic and plastic conditions which may be sufficiently accurate for many purposes. Simple expressions are also derived for the loads on the anti-bowing grids and end support plates. (auth)

9623 (TRG-Report-599) THE ELASTOPLASTIC THERMAL BOWING OF NUCLEAR FUEL PINS. SOLUTIONS TO FOUR PROBLEMS. L. R. T. Gardner and D. Fenna (United Kingdom Atomic Energy Authority. Reactor Group, Springfields, Lancs, England). July 29, 1963. 17p.

The following four elastoplastic thermal bowing problems are discussed in detail: (1) bowing of an unbraced fuel pin encastered at both ends, (2) bowing of an unbraced fuel pin encastered one end and simply supported at the other, (3) bowing of an unbraced fuel pin simply supported at both ends, and (4) bowing of a fuel pin simply supported at both ends, braced at its mid-point and having different linearly varying transverse temperature gradients over its two halves. Expressions for the profile of the pin and the loads on the end support plates (and grid) are obtained for the cases when the transverse temperature gradient is either uniform or a linearly varying function of axial position. (auth)

9624 (WAPD-T-1608) ISOTOPIC COMPOSITION OF PWR CORE 1 BLANKET IRRADIATED TO 16,000 MWD/METRIC TON U: THEORY VS EXPERIMENT. C. D. Sphar (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Sept. 1963. Contract AT(11-1)-Gen-14. 27p. (CONF-360-10)

From American Nuclear Society Topical Meeting, Nuclear Performance Power Reactor Cores, San Francisco, Sept. 1963.

The comparison of measured postirradiation isotopic content of blanket fuel with theoretical values indicates that no gross inadequacies exist in the techniques employed in the calculation of the behavior of natural uranium. Although disagreement between experiment and theory approaches 20% at worst for individual rods for the important quantities such as uranium-235 depletion, total plutonium production and content, and energy generation, the general discrepancy in any of these quantities is well within 10%. Somewhat larger discrepancies exist in the concentrations of the higher mass isotopes of plutonium, but these are reduced significantly by use of the latest cross section data for plutonium. (auth)

9625 (EURAEC-808) INTRODUCTION OF TWISTED TAPE IN A SENN-TYPE SUBASSEMBLY. Special Report No. 10. (Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Suresnes, France). Apr. 10, 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 058-61-7RDF. 98p. (A translation)

The design and fabrication of a SENN-type fuel subassembly with blocks of welded twisted tapes of stainless steel or Zircaloy-2 are described. A hydraulic and thermal study was made of the effects of twisted tape on pressure drop and flow distribution in the channels in the fuel subassembly. Calculations were made of the effects of twisted tape on the infinite multiplication constant. (D.L.C.)

9626 AN ESTIMATE OF FUEL ELEMENT CAN THICKNESS TO PREVENT INTOLERABLE PLUTONIUM PENETRATION. M. V. Speight (Berkeley Nuclear Labs., Berkeley, Gloucester, Eng.). J. Nucl. Energy, Pt. A & B, 17: 440-1(Dec. 1963).

The prevention of intolerable plutonium penetration, causing contamination of reactor coolant, by can thickness is described mathematically for two cases; when the solubility limit of the can is reached in the fuel element lifetime

and when the solubility limit is reached instantaneously. The optimum condition is shown to be in an in-between time. (R.E.U.)

9627 ECONOMICS OF RECYCLED FUELS. M. C. Edlund (Babcock and Wilcox Co., Lynchburg, Va.). Proc. Am. Power Conf., 25: 128-33(1963).

Recycle of the bred fuels is required to make nuclear power economically competitive with fossil fuels under private ownership of fuel in the near future. Current work on recycle processes shows that the bred fuels can be recycled at relatively low cost when the throughput in a given plant exceeds 0.5 tons of oxide per day. The thorium-uranium cycle will probably result in lower fuel costs for the PWR and definitely lower fuel costs in the SSCR. The lowest fuel costs will be obtained in the SSCR operating on the thorium cycle. Fuel costs of about 1 mill per kwhr can be expected by 1980 with no subsidy from the Government. (auth)

9628 TRANSPORT AND DIFFUSION OF FISSION PRODUCTS IN GRAPHITE. J. Bromley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 173-220(1963).

The processes involved in the diffusion and migration of fission products in graphites that are used as both can and moderator, e.g., dispersion fuel elements, in high-temperature reactors are discussed. The chemical state of the fission products, the paths followed by the fission products in fuel–graphite systems, the theory of the diffusion processes, and some experimental data on fission product migration in graphite are considered. 98 references. (R.E.U.)

9629 PRINCIPLES AND PROBLEMS OF THE DEVELOPMENT OF A FAST REACTOR FUEL ELEMENT. Wolf Haefele (Kernforschungszentrum Karlsruhe, Ger.). 42p. (CONF-334-17)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

The principles and problems involved in the development of fuel elements for large fast oxide breeder reactors are discussed. A closed Pu fuel cycle is considered. The inherent safety due to the Doppler coefficients is discussed as a principle concern in fuel element development. A cost analysis is presented. (R.E.U.)

9630 IMPROVEMENTS IN NUCLEAR FUEL ELEMENTS AND A METHOD OF MANUFACTURING SUCH ELEMENTS. (to Babcock and Wilcox Ltd.). British Patent 942,852. Nov. 27, 1963. Priority date Oct. 7, 1960, Germany.

A fuel element is described wherein the nuclear fuel is dispersed in lead-free silica glass or quartz which acts as an absorber of gaseous fission products. The element is dispersed in a thermal conductor of carbon. (R.E.U.)

9631 CAN FOR NUCLEAR FUEL ELEMENTS. Marc Salesse and Jacques André Stohr (to Commissariat à l'Energie Atomique). German Patent 1,153,465. Aug. 29, 1963. Priority date Mar. 17, 1960, France.

The can described is provided with helical cooling fins that are subdivided in an axial direction. The neighboring sections of the fins are tilted in opposite directions. (Gmelin Inst.)

Power and Power-Breeder Reactors

9632 (ACNP-63006) PATHFINDER ATOMIC POWER PLANT. BURNUP LIMITS FOR PATHFINDER TWO WEIGHT PER CENT NATURAL BORON–STAINLESS STEEL CONTROL RODS. D. A. Patterson and D. A. Nehrig (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Dec. 19, 1963. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. 27p. Contract AT(11-1)-589.

A survey of literature on irradiation experience with boron stainless steel was conducted to determine the effect of neutron irradiation and boron-10 burnup on the two weight per cent natural boron stainless steel control rods being used in the Pathfinder reactor. The literature reviewed included irradiation test samples and full-size control rods in operating reactors. From the analysis of the survey, it was concluded that the Pathfinder control rods will operate satisfactorily and retain their integrity within the burnup limits prescribed. The effects of irradiation and boron-10 burnup on boron stainless were divided into the categories of mechanical properties, cracks, and swelling and gas release. These categories were examined in detail with the data available and correlated with the Pathfinder rods and operating conditions. The allowable local burnup of the boiler rods is limited to one core at. % (50% boron-10 depletion) and the superheater rods are limited to one-half core at. % (25% boron-10 depletion). (auth)

9633 (ACNP-63026) PATHFINDER ATOMIC POWER PLANT. RECIRCULATION PIPING DESIGN. D. J. Nolan and J. F. Patterson (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Jan. 10, 1964. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates. Contract AT(11-1)-589. 137p.

The coolant recirculation system in the Pathfinder reactor comprises three mixed-flow centrifugal pumps and three piping loops. The design criteria are summarized; and flexibility and stress analyses on the piping are presented, together with a vibration analysis of one pump and loop. The results indicate that vibration should be no problem, that all stresses are within the allowable limits, and that there should be no resonance difficulties during pump operation. (D.C.W.)

9634 (ACNP-63034) PATHFINDER ATOMIC POWER PLANT. Technical Progress Report, July–September 1963. (Allis-Chalmers Mfg. Co. Atomic Energy Div., Milwaukee). Dec. 30, 1963. For Northern States Power Co., Minneapolis and Central Utilities Atomic Power Associates). Contract AT(11-1)-589. 48p.

Progress in the development of the Sioux Falls Power Reactor is reported. Information is presented on: design of underwater control-rod cutting facility; xenon transient studies; dynamic performance; pre-critical testing; rod-drop calculations; and design of instrumented superheater fuel element assemblies. (N.W.R.)

9635 (ANL-5719(Add.)) ADDENDUM TO HAZARD SUMMARY REPORT EXPERIMENTAL BREEDER REACTOR-II (EBR-II). L. J. Koch, W. B. Loewenstein, and H. O. Monson (Argonne National Lab., Ill.). Jan. 7, 1964. Contract W-31-109-eng-38. 327p.

The changes and verifications of the design, operating conditions and procedures, test procedures, and nuclear characteristics that have evolved during construction are described, together with additional experimental and theoretical studies. The various hazards considerations are summarized. (D.C.W.)

9636 (ANL-6632) NONDESTRUCTIVE TESTS OF COMPONENTS OF EBR-I, CORE IV. R. H. Selner, C. J. Renken, R. B. Perry, and K. Balaramamoorthy (Argonne National Lab., Ill.). Oct. 1963. Contract W-31-109-eng-38. 31p.

Eddy-current and ultrasonic tests on zirconium rod stock and wire, Zircaloy-2 tubing and rod stock, and stainless steel tubing for use in various core components are summarized. Eddy-current tests were also performed on the NaK annulus of assembled blanket elements. (D.C.W.)

9637 (BNL-7592) CHARACTERISTICS OF FAST SETTLED-BED REACTORS. Jack Chernick (Brookhaven National Lab., Upton, N. Y.). Oct. 1963. Contract AT-30-2-GEN-16. 12p. (CONF-334-18)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

The Fast Settled Bed Reactor is a high-temperature, particulate-fueled, breeder concept being studied at Brookhaven. The core is a pot of densely packed fuel lumps through which a liquid metal is pumped downward. During reactor shutdown, the flow is reversed and the bed is fluidized for removal. Two alternate reactor designs are shown. The geometrical stability of the reactor and the effects of container walls and compaction on the packing densities are discussed. A zero-power critical experiment being planned to study the stability and control of a settled bed reactor is described. (D.L.C.)

9638 (BNL-7593) NUCLEAR PARAMETER STUDIES OF THE FAST SETTLED-BED REACTOR. M. M. Levine and A. Aronson (Brookhaven National Lab., Upton, N. Y.). [Oct. 1963]. Contract [AT(30-2)-Gen-16]. 27p. (CONF-334-19)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

The results of studies on the performance characteristics of fast breeder reactors using the settled-bed concept are discussed. Burnup, temperature coefficients, static characteristics, composition changes, and the effects of bed density shifts in both axial and radial flow geometries were considered. A reactor power of 825 Mw, UC and PuC fuel, UC blanket, 12.8 fuel density, and Na coolant were used. (D.C.W.)

9639 (CONF-332-8) PRELIMINARY RESULTS OF VBWR NOISE ANALYSIS. Philip R. Pluta (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Oct. 21, 1963. Contract AT(04-3)-189. 34p.

From Symposium on Noise Analysis in Nuclear Systems, Gainesville, Fla, Nov. 1963.

Flux and flow data from the Vallecitos Boiling Water Reactor were statistically analyzed in the time and frequency domain. These results show the difficulty associated with an attempt to obtain useful, quantitative design information from limited boiling water reactor noise data. The reactivity driving power spectral density function was determined from flux power spectral density and rod oscillator transfer function measurements, and found to be non-white. The continuing analysis of boiling water reactor noise data shows what the statistical behavior of the reactor is at various operating conditions and guides the quantitative selection of a model which will describe the data. Experimental and theoretical work is needed to be done which will permit a quantitative "a priori" noise analysis of a boiling water central power station, and will give acceptable agreement with plant data over a wide range of operating conditions. (auth)

9640 (CONF-360-9) NUCLEAR PERFORMANCE OF LARGE PRESSURIZED WATER REACTORS CONTROLLED BY SOLUBLE POISON. R. J. French and D. L. Miller (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Sept. 1963. Contract AT(30-1)-3064. 26p.

From American Nuclear Society Topical Meeting, Nuclear Performance Power Reactor Cores, San Francisco, Sept. 1963.

The performance of large pressurized-water reactors operated with a uniformly distributed control technique such as a soluble neutron poison (boric acid) dissolved in the moderator is investigated. The cycling studies are performed in one dimension. (C.E.S.)

9641 (CVNA-188) CVTR TRAINING MANUAL. M. A. Bell and K. R. Hovatter (Carolinas Virginia Nuclear Power Associates, Inc., Parr, S. C.). Sept. 1963. 380p.

Material used by the personnel who obtained the initial operators' licenses on the Carolinas-Virginia Tube Reactor (CVTR) is presented. Reactor design, behavior, characteristics, and operations are covered, together with pertinent health physics information. Areas covered by the AEC licensing examinations are indicated, and review questions and answers for the CVTR are included. (D.C.W.)

9642 (DLCS-5001163) MONTHLY OPERATING REPORT, NOVEMBER 1963. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 52p.

The station operated at steady-state full power output except for 10 day period of maintenance and testing. The main unit generator was shut down for 15 hours during which time the overhead 138 KV lines were deenergized to permit the erection of rigging on the roof of the Fuel Handling Building. Reference water conditions were maintained in all systems. The biocide treatment initiated last month has effectively controlled the biological fouling in the RWDS. All personnel radiation exposures were within specified limits. During the removal of the core removal cooling system spool piece several personnel were splashed by reactor coolant, however normal decontamination and survey procedures utilized were successful in decontaminating all personnel involved. Construction of the decontamination system was still in progress with the major portion of the work remaining in the tie-in to the existing RWDS. The HDS major modifications work was begun. (auth)

9643 (DP-864) THORIUM-FUELED D_2O-MODERATED POWER REACTORS. Dale F. Babcock, Ramon R. Hood, and Daniel S. St. John, comps. (Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.). Dec. 1963. Contract AT(07-2)-1. 40p.

An appraisal of the current technological status of D_2O-moderated reactors that are fueled with thorium is presented; also included is a description of the research and development program that would be required for a demonstration of U^{233} breeding in a D_2O-moderated prototype power reactor. It is concluded that U. S. development of D_2O-moderated reactors should be continued so as to realize the following attributes of such reactors: breeding with thorium in a reactor that can produce economical electric power and greater extension of U. S. uranium reserves than with any converter-breeder combination proposed to date. (auth)

9644 (GEAP-4414) REACTOR SAFETY AND FUEL CYCLE ECONOMICS CONSIDERATIONS FOR FAST REACTORS. K. P. Cohen, P. Greebler, M. J. McNelly, P. M. Murphy, D. B. Sherer, and E. L. Zebroski (General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.). Nov. 11, 1963. Contract AT(04-3)-189. 19p. (CONF-334-20)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

A core design study of a 10 Mw(e) fast ceramic reactor is presented. Local reactivity coefficients, safety criteria,

accident analyses, and economics are considered. An attempt is made to find a new balance of characteristics by purely geometric devices, i.e., by exploring the sodium: fuel ratio and varying the height: diameter ratio of the core. The use of BeO in the core was also investigated. (C.E.S.)

9645 (HW-61240) DC BRIDGE FOR NPR HORIZONTAL ROD COUNTING. M. L. Faught (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). July 24, 1959. Contract AT(45-1)-1350. 24p.

The horizontal rod counting circuitry of the NPR ball safety system backup for horizontal rods uses a d-c bridge network. The principles of a counting bridge are presented, together with the general bridge equations and the design criteria used. Bridge component selection, optimization, and tolerances are then summarized; and the physical and operating characteristics of the two types of bridge counting circuits used are discussed. (D.C.W.)

9646 (HW-78388(p.11.1-15)) PLUTONIUM RECYCLE TEST REACTOR OPERATION AND RELATED ACTIVITIES. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

There were 24 operating periods for the PRTR, which provided 2,844 Mwd with an average experimental time efficiency of 61.4%. Control rod calibrations and direct measurements of safety system time response in the Plutonium Recycle Critical Facility were completed. Testing was continued aimed at control of impact or fretting corrosion of zirconium in the PRTR pressure tubes and fuel elements. Tests were made of the dissolution of plutonium ceramic cores using irradiated $MgO-PuO_2$ fuel rod sections. A 1.7 M sulfamic acid solution with inhibitors was used for the dissolution. Heat transfer experiments were made with an electrically heated test section to provide information concerning the occurrence of boiling burnout with a 19-rod bundle fuel element that is cooled with wet steam. Plutonium burnup studies were made. (M.C.G.)

9647 (HW-SA-3294) DESIGN CONSIDERATIONS AND OPERATING CHARACTERISTICS OF THE PLUTONIUM RECYCLE GAS-COOLED LOOP FACILITY (thesis). Dixon P. Schively (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 13, 1963. Contract AT(45-1)-1350. 38p.

The gas loop and design tests concerned primarily with the flow characteristics of the system are described. Stable parallel operation of the hydrodynamic gas-bearing compressors provided for the PRTR gas-cooled loop facility was demonstrated with an inlet temperature of 660°F and a pressure of 285 psi. Loop capability to operate at design (1500°F) heater outlet temperature was also demonstrated. Two defects were noted. The loop was not operated at design pressure because of gas leaks at the heater nozzles. Further, maximum power input to the heater was 110 kw compared with a design input of 150 kw. (auth)

9648 (JAERI-1051) HELIUM PURIFICATION SYSTEM OF HIGH TEMPERATURE GAS-COOLED REACTOR. Eizo Sugimoto, Atsuyoshi Morishima, Keiichi Oshima, and Keiji Naito (Japan Atomic Energy Research Inst., Tokyo). Aug. 1963. 55p. (In Japanese)

The proposed system is described, and its projected characteristics are given. The results of evaluations of the concepts and materials employed are included. (D.C.W.)

9649 (NYO-9990) EURATOM REACTOR FUEL MANAGEMENT PROGRAM. PART I. SYNTHESIS OF RESULTS. (Jackson and Moreland, Inc., Boston and Allis-Chalmers Mfg. Co., Milwaukee). Jan. 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2875. (EURAEC-803(Pt.I)). 242p.

The effects of single and multiple batch radial fuel management programs on total plant cost were determined for the SENN dual-cycle boiling water reactor which was selected as a reference design. The effect of fuel management on power cost results from the potential of increased fuel exposure and increased power density of the reactor. Incentives for management of fuel in the reference plant were determined to be in excess of 3 mills/kwh for a four-to-five zone, out-in refueling scheme. Where several weeks' downtime (i.e., 6–8) are required for refueling operations, cost penalties exceed 1 mill/kwh as a result of reduced availability. Related effects on fuel management of rod programming and transfer to equilibrium are discussed with recommendations for a more optimum method of fuel management for the reference reactor. (auth)

9650 (ORNL-TM-730) MSRE DESIGN AND OPERATIONS REPORT. PART III. NUCLEAR ANALYSIS. P. N. Haubenreich, J. R. Engel, B. E. Prince, and H. C. Claiborne (Oak Ridge National Lab., Tenn.). Feb. 3, 1964. Contract W-7405-eng-26. 204p.

Preliminary considerations of the effects of core size and fuel-to-moderator ratio on critical mass and fuel concentration led to the specification of a core about 4.5 ft in diameter by 5.5 ft high. The average fuel fraction was set at 0.225. The nuclear characteristics of the reactor were examined for three combinations of fissile and fertile material (UF_4 and ThF_4) in a carrier salt composed of Li, Be, and ZrF_4. The radial distribution of the thermal neutron flux is strongly influenced by the presence of three control-rod thimbles near the axis of the core, with the result that the radial thermal flux maximum occurs about 8 in. from the axis. The axial distribution is essentially sinusoidal. The magnitude of the thermal flux depends on the choice of the fuel. Both the fuel and the moderator temperature coefficients of reactivity are substantially negative, leading to prompt and delayed negative power coefficients. Reactivity coefficients were also calculated for changes in uranium concentration, Xe^{135} concentration, and fuel-salt and graphite densities. Temperature distributions in the fuel and graphite in the reactor were calculated for the design power level. With the fuel inlet and outlet temperatures at 1175 and 1225°F, respectively, the fuel and graphite reactivity-weighted average temperatures are 1211 and 1255°F, respectively. Fuel permeation of 2% of the graphite volume would increase the graphite weighted average temperature by 7°F. The power coefficient of reactivity with the reactor outlet temperature held constant is –0.006 to –0.008% δk/k per Mw. Circulation of the fuel at 1200 gpm reduces the effective delayed neutron fraction from 0.0067 to 0.0036. Xenon poisoning is strongly dependent on the major competing mechanisms of stripping from the fuel in the pump bowl and transfer into the bare graphite. The equilibrium poisoning at 10 Mw is expected to be between –1.0 and –1.7% δk/k. The fuel contains an inherent neutron source of over 10^5 n/sec due to α,n reactions in the salt. This meets all the safety requirements of a source, but an external source will increase the flux for convenient monitoring of the subcritical reactivity. The total worth of the three control rods ranges from 5.6 to 7.6% δk/k, depending on the fuel salt composition. Shutdown margins at 1200°F are 3.5% δk/k or more in all cases. Calculations were made for conceivable reactivity accidents involving uncontrolled rod withdrawal, "cold slugs," abnormal fuel additions, loss of

graphite, abnormal rilling of the reactor, and primary flow stoppage. No intolerable conditions are produced if the reactor safety system (rod drop at 150% of design power) functions for two of the three rods. The biological shield, with the possible addition of stacked concrete blocks in some areas, reduces the calculated radiation dose rates to permissible levels in all accessible areas. (auth)

9651 (SL-1974-1) ENGINEERING EVALUATION STUDIES, HEAVY WATER MODERATED POWER REACTOR PLANTS. Quarterly Progress Report, April–June 1962. (Sargent and Lundy, Chicago). July 16, 1962. Contract AT(38-1)-213. 29p.

Work on the computer program for the economic optimization of D_2O moderated power reactors, which is being done in conjunction with du Pont, is continuing. Complete operating and cost data characterizing all the 300 Mw(e) turbine plants are presented. The design and cost equations for the 300 Mw(e) liquid D_2O, boiling D_2O and organic cooled reactor plants are also discussed. Turbine cycle efficiency curves as a function of final feed water temperature are presented for all the H_2O, 500 and 1000 Mw(e) turbine plants. Major mechanical equipment sizes for these turbine plants have been established and work is continuing with the preparation of general arrangement drawings and the compilation of cost data. The design and cost equations for 300 Mw(e) liquid D_2O, boiling D_2O, and organic cooled reactor plant auxiliaries and structures are being reviewed to determine any revisions necessary for extending their use to the plants of 500 and 1000 Mw(e). Work on the fog and gas cooled reactor plants has not yet been initiated. (D.L.C.)

9652 (SRO-97) HEAVY WATER POWER REACTOR PROGRAM. Monthly Progress Report, December 1963. (Savannah River Operations Office, AEC). 10p.

Progress made in the development and operation of heavy water reactors is reported. Information is included on the fabrication and testing of the on-power refueling machine for the CANDU reactor, creep-rupture testing of SAP, nondestructive testing of fuel cladding, operation of HWCTR, development and operation of CVTR, development of DDCR, heat transfer and fluid dynamics of reactor fuel elements and rod bundles, development of fog-cooled reactors, zirconium technology, fuel irradiation programs, and reactor physics. (N.W.R.)

9653 (WAPD-BT-29(p.1-18)) OPERATOR-INDUCED XENON OSCILLATION. S. G. Margolis (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Oscillations in rod position accompanied by axial flux tilting occasionally occur during constant power operation of PWR Core 1. A small-perturbation analysis of this mode of oscillation is presented which uses the boundary search option of standard diffusion-theory digital programs to account for the effects of rod motion upon the core's static flux tilt sensitivity. The procedure consists of dividing the core axially into two regions, poisoning the thermal group of each region separately, restoring criticality by moving the rod boundary, and observing the change in steady-state power in each region. This small-perturbation analysis was applied to an example core which was shown unstable by a ZIP time-series calculation. The small-perturbation theory also indicated instability of the same model core, and showed that instability is likely whenever the percent power change per percent poison exceeds 20. (auth)

9654 (WAPD-BT-29(p.29-43)) THE FABRICATION OF PWR CORE 2 SEED FUEL WAFERS. T. J. Burke, H. H. Crain, Jr., and R. D. Frank (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

The process employed for the fabrication of 1,300,000 high-density, enriched, urania-zirconia fuel wafers for the first seed of PWR Core 2 is described. Three different zones of uranium enrichment required fuel wafers composed of 36.5 wt % $U^E O_2-ZrO_2$, 27.4 wt % $U^E O_2-ZrO_2$, and 19.3 wt % $E^E O_2-6.7$ wt % $U^N O_2-ZrO_2$. The process basically involved the formation of an intimate, uniform mixture of virgin UO_2 and ZrO_2 powders, agglomeration, granulation, hydrogen calcining to produce granules of UO_2-ZrO_2 solid solution, comminution to produce a highly sinterable material, agglomeration, granulation, and screen sizing to produce a free-flowing powder for dry pressing. Green wafers were hydrogen sintered to achieve a minimum density of 94% of theoretical and a closely controlled thickness dimension. The wafers were ground to length and width and coated with a carbon barrier layer. (auth)

9655 (WAPD-BT-29(p.59-68)) MEASURING POWER DISTRIBUTIONS IN PWR. J. H. Leonard and H. Renner (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh).

Considerable data were obtained from the instrumentation in PWR Core 1 since operation commenced in December 1957. Considerations pertinent to the evaluation of this data are presented. It is shown that calculated power distributions are generally confirmed by the instrumentation data. Improvements to PWR-type instrumentation are identified which would provide more refined power information. (auth)

9656 THE DOUNREAY FAST REACTOR EXPERIMENT. Atom, No. 86, 356-65; 70(Dec. 1963).

The development and nature of the Dounreay Fast Reactor Experiment to study the feasibility of the fast reactor concept are presented. A discussion of the most important aspects of the experiment include: handling and purity control of large quantities of liquid metal; control of a fast reactor at a steady power level; and the behavior of metallic fuel under irradiation. The experimental facilities are illustrated. Plans for an experimental irradiation program are mentioned. (L.B.S.)

9657 THE AKB PROJECT FOR A GAS-COOLED HEAVY-WATER POWER REACTOR. W. Keller (Siemens-Schuckertwerke AG, Erlangen, Ger.). Atomwirtschaft, 8: 645-54(Dec. 1963). (In German)

A heavy-water power reactor with a pressure tube construction is being designed for the Gesellschaft für die Entwicklung der Atomkraft in Bayern (AKB). Two concepts were decisive for this type of construction: the pressure tubes in which the fuel elements are situated assume the pressure of the cooling medium; and the moderator is so completely separated from the cooling medium by the pressure tubes that cooling with heavy water is not absolutely necessary. From a study of the advantages and disadvantages of different cooling media it was found that only by using heavy water or gas cooling could the reactor be developed to full scale within the framework of the project. Finally preference was given to CO_2 cooling since it is free from the temperature limitation of pressurized and boiling water reactors and permits steam raising processes such as are normal in modern conventional power stations. Since at the projected high cooling-gas temperatures recourse could not be made to a serially tested type of fuel element considerable development was, and is, necessary in the field of fuel elements. The power rating of 100 Mw(e) laid down for the AKB project was chosen to keep the ab-

solute capital expenditure for a prototype at a reasonable level and to have a high enough power density and level to make a practical test of the fuel elements and cooling system at the loading occurring in larger reactor units. (auth)

9658 PROTECTION SYSTEM EXPERIENCE AT SHIPPINGPORT. A. I. Moss (Westinghouse Electric Corp., Pittsburgh). Automatic Control, 15: No; 6, 53-7(Dec. 1961).

The Reactor Protection System of Shippingport Atomic Power Station is described, and the experiences gained during the life of the first seed of the core are reported. Shutdown incidences are reported and analyzed. Major conditions for shutdown reported are overpower, loss of coolant flow, and rapid insertion of cold water in the core. (R.E.U.)

9659 LONG TERM NUCLEAR ENERGY ECONOMY. R. Gibrat. Energie Nucl., 5: 485-500(Nov. 1963). (In French)

The American Atomic Energy Commission declared that "alone, the use of breeders will resolve the eventual problem of bringing a convenient energy to future generations." The subject of a lecture entitled "Is it necessary to sacrifice the present and near future of nuclear energy to the future?" is developed. A model is established that allows the analysis of the influence of various parameters (production of plutonium from a converter, from a breeder, initial load in plutonium of a breeder, and delay in the availability of plutonium. This model admits an exponential variation in the nuclear power available but allows the voluntary variation of the exponent. The problem is presented in detail. The first part is a study of the exponential model and gives the results obtained. The second part concerns the stock market and the price of plutonium. The mathematical calculations are given in an appendix. (auth)

9660 THE EXPERIMENTAL NUCLEAR POWER PLANT AT LUCENS. P. de Haller and W. Heibling. Energie Nucl., 5: 501-11(Nov. 1963). (In French)

The experimental nuclear power plant being constructed 25 km from Lausanne, represents the first Swiss project in the field of the production of nuclear power, and will aid in the solution of problems encountered in the building of large size nuclear power plants. Before describing the reactor and associated equipment for the generation of steam, the reasons are reviewed that led Switzerland to study power reactors and the considerations that determined the choice of the system, viz. heavy-water moderator and uranium metal fuel elements canned with magnesium and enclosed in the force tubes where the cooling fluid (carbon dioxide) circulates. (auth)

9661 THE GARIGLIANO NUCLEAR POWER PLANT. Euratom Bull., No. 4, 4-12(Dec. 1963).

The design and construction of the first Euratom full-size BWR power plant are described. The testing schedule leading to criticality June 5, 1963, is given. (R.E.U.)

9662 THE LATINA NUCLEAR POWER PLANT. P. Montois. Euratom Bull., No. 4, 13-19(Dec. 1963).

The design and construction of the Latina Power Plant are described. The stages leading to criticality are given. (R.E.U.)

9663 THE ARDENNES NUCLEAR POWER PLANT. J. Ehrentreich and W. Kaut. Euratom Bull., No. 4, 20-5 (Dec. 1963).

The design and construction of the Ardennes Power Plant in France by SENA are described. Siting of the plant and the reactor and its out-of-pile components are discussed. (R.E.U.)

9664 THE GUNDREMMINGEN NUCLEAR POWER PLANT. J. Desfosses, W. Kaut, and J. S. Terpstra. Euratom Bull., No. 4, 26-7(Dec. 1963).

The design and present status of the Gundremmingen Power Plant in Germany on the Danube are discussed. The plant will have a rated power of 801 Mw(th) and net power of 237 Mw(e). The boiling-water reactor is light-water cooled and moderated, with forced circulation and a double direct cycle; the fuel is enriched UO_2. (R.E.U.)

9665 THE DUTCH NUCLEAR POWER PLANT PROJECT. J. S. Terpstra. Euratom Bull., No. 4, 28-9(Dec. 1963).

The future construction of a single-cycle boiling-water reactor of 165 Mw(th) at Doodewaard in the Netherlands is discussed. The current progress is reviewed. (R.E.U.)

9666 CHEMICAL PROBLEMS IN THE OPERATION OF THE DOUNREAY. Ind. Chemist, 39: 186-94(Apr. 1963).

The problems encountered in obtaining chemical compatibility of fuel element, canning material, and coolant and the effects of impurities in the coolant system are described for the Dounreay Fast Reactor. (C.E.S.)

9667 NUCLEAR ENGINEERING IN WESTERN EUROPE. II. THE WEST EUROPEAN REACTOR INDUSTRY (OUTSIDE GERMANY). D. NUCLEAR ENGINEERING IN GREAT BRITAIN. K. Diebner. Kerntechnik, 5: 499-505(Dec. 1963). (In German)

A survey is presented of the nuclear engineering industry in Great Britain. Projects of separate companies are discussed. (R.E.U.)

9668 UTILITY SYSTEM CONDITIONS FAVORABLE TO EARLY INSTALLATION OF NUCLEAR POWER. R. K. Andersen (General Electric Co., San Jose, Calif.), W. N. Oberly, J. J. Heagerty, and W. D. Marsh. Proc. Am. Power Conf., 25: 166-77(1963).

For the 2000- and 4000-Mw systems studied, nuclear power is economically attractive over a wide range of assumed alternative fossil plant costs. In optimum system expansion patterns, nuclear savings occur for fossil fuel costs above 25 cents per million Btu in the range of normal fossil plant costs. There is an added economic incentive to nuclear power in larger systems because of the better economics of large nuclear units relative to fossil units. Nuclear power can contribute most to low total system power cost when it is combined in a mixed pattern expansion with some form of low-cost peaking generation. For a given system, the economic unit size for nuclear units is larger than for fossil units. In competition with fossil units, the low incremental fuel costs of nuclear units can result in heavier loadings and higher lifetime capacity factors. (auth)

9669 WORLD STATUS AND FUTURE OF FAST REACTORS. L. J. Koch (Argonne National Lab., Ill.). Proc. Am. Power Conf., 25: 178-88(1963). (TID-18595)

Tables of the fission energy content of domestic nuclear resources are given which show that fast reactors can extend the energy resources when fossil fuels are depleted. The status of fast reactors in U.S. and other countries is reviewed. It is concluded that fast breeder development should be pursued to the point of successful application in the next 15 to 20 years. At that time large plants should be introduced into the overall power system to begin im-

proving overall fuel utilization. By the end of this century, a significant fraction of the nuclear power should be generated by fast breeders and new capacity should be added, largely with fast breeders. (D.L.C.)

9670 PROSPECTS FOR NUCLEAR POWER. Manson Benedict (Massachusetts Inst. of Tech., Cambridge). Proc. Am. Power Conf., 25: 245-58(1963).

A personal survey is presented of nuclear power in the future and of the development of nuclear power plants. The status of various reactor systems is reviewed: water-cooled, heavy-water, gas-cooled, and sodium-cooled reactors. Forecasted costs of these systems are compared with costs of a conventional plant. It is concluded that reactors with better utilization of U and Th than in light-water reactors will be needed in the future. The best prospects for this improved utilization are heavy-water reactors, high-temperature gas-cooled reactors, and sodium-cooled fast breeder reactors. A group discussion is included. (D.L.C.)

9671 REVIEW OF ENGINEERING RESEARCH FOR THE DEVELOPMENT OF HIGH TEMPERATURE REACTORS. L. A. Husain (Atomic Energy Establishment, Winfrith, Eng.). Progr. Nucl. Energy, Ser. IV, 5: 479-502 (1963).

Problems encountered in high-temperature gas-cooled reactor engineering are discussed. The characteristics of high-temperature reactors are discussed, and major design requirements are presented. The Dragon, HTGR, and BBC-Krupp Pebble Bed reactors are discussed. (R.E.U.)

9672 OPERATING EXPERIENCE WITH POWER REACTORS. VOL. I. Proceedings of the Conference held at Vienna, 4-8 June 1963. (International Atomic Energy Agency, Vienna). Proceedings Series. Oct. 1963. 534p. (STI/PUB/76(Vol. I)). $10.00; Sch 210,-; 60s.stg; F,fr.40.-; DM 35,-(IAEA)

Separate abstracts were prepared for ten of twenty-two papers on the development, status, performance, and use of power reactors and on some associated concepts and systems. The other papers were previously abstracted in NSA. (D.C.W.)

For abstracts of individual papers see: 9673, 9674, 9675, 9676, 9677, 9678, 9679, 9680, 9681, and 9682.

9673 OPERATING EXPERIENCE IN NUCLEAR POWER-PLANTS WITH BOILING-WATER REACTORS. R. J. Ascheri (General Electric Co., San Jose, Calif.). p.27-35 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963.

Experience with three power plants is cited showing the high reliability, availability, and safety of boiling reactors. Adaptability to continuing upgrading and new technology is also noted. The reactors also displayed ease of operation and maintenance. (D.C.W.)

9674 REVIEW OF DEVELOPMENT STATUS OF NUCLEAR SUPERHEAT. D. H. Imhoff and R. T. Pennington (General Electric Co., San Jose, Calif.). p.37-85 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963.

The three major superheat fuel irradiation facilities at General Electric and the activities in the two major development programs are briefly described. Significant results are summarized. 65 references. (D.C.W.)

9675 COMMISSIONING EXPERIENCE FROM THE ÅGESTA NUCLEAR POWER PLANT. N. Rydell (Ågesta Kraftvärmewerk, Farsta, Sweden). p.127-38 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963.

During the commissioning of the plant, which uses a pressurized heavy water reactor of the pressure vessel type fueled with natural uranium oxide, observations were made essentially on primary circuit cleanliness and pressurization, valve operation, water leakage, refueling machinery, and containment testing. The results are summarized. (D.C.W.)

9676 SHIPPINGPORT ATOMIC POWER STATION OPERATING EXPERIENCE, DEVELOPMENTS AND FUTURE PLANS. H. Feinroth (U. S. Atomic Energy Commission, Washington, D. C.), G. M. Oldham, and J. T. Stiefel. p.209-82 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963.

Five years of operation and test of the Shippingport Atomic Power Station are described and evaluated, and the current technical developments and future plans of the Shippingport program are discussed. The program is directed towards development of the basic technology of light-water reactors to provide the basis for potential reduction in the costs of nuclear power. (auth)

9677 OPERATING EXPERIENCE AT THE YANKEE ATOMIC ELECTRIC COMPANY NUCLEAR POWER STATION. L. E. Minnick (Yankee Atomic Electric Co., Boston). p.325-33 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963.

Since its initial operation in November 1960, the station has generated over 2×10^9 kwh gross. The overall use factor from first generation of power in 1960 is just over 67%. The economic picture is also very encouraging. The Yankee plant is not only continuing to demonstrate its ability to supply base-load power for the New England area but is also providing new information of benefit to the economics of all closed-cycle reactors. Problems have been encountered, some of a fairly significant nature, but every indication to date is that these are correctable and that plant operation will become even more dependable with continually improving economics as time goes on. (auth)

9678 THE DEVELOPMENT OF CALDER HALL AND CHAPELCROSS AS BASE LOAD NUCLEAR POWER STATIONS. J. McCrickard (United Kingdom Atomic Energy Authority, Annan, Dumfriesshire, Eng.). p.407-23 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963.

Practical experience on the effects of different absorber patterns and configurations of partially inserted control rods permitted a power output increase of one-third over the initial design figure. As a result, the turbo-alternators were modified to increase their outputs from 21 to 27/30 Mw to handle the extra steam. The overall load factor was also increased over the seven years from about 70 to 93%, largely by reducing refueling times. Losses due to fuel element failures were also very small. Fuel element design irradiations were successfully fitted into the operation program. (D.C.W.)

9679 SLUG-BURST DETECTION IN THE G3 REACTOR. J. Plisson (CEN, Marcoule, France). p.471-86 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The slug-burst detection system (described) of the G3 reactor features fully automatic operation, data centrali-

zation in the control room, and measurement of the activity of the coolant gas by electrostatic collection of ions on a turning electrode. In four years, the system has successfully handled twelve failures, four of them quite rapid and violent. (D.C.W.)

9680 AUTOMATIC TEMPERATURE CONTROL IN THE G2 AND G3 REACTORS. J. Meiffren (CEN, Marcoule, France). p.487-503 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The reactors are equipped with electronic computers that process the data received from 1200 thermocouples at the channel exits. The apparatus for monitoring the temperatures and for processing and displaying the data are described. (D.C.W.)

9681 ORGANIZATION AND TRAINING OF THE G2 AND G3 REACTOR PERSONNEL. F. Conte (CEN, Marcoule, France). p.505-14 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

A detailed description of the organizational system associated with the G2 and G3 reactors (operations section, maintenance and works service) is given, together with a review of personnel training. (auth)

9682 EXPERIENCE IN NEUTRON PHYSICS ACQUIRED AT MARCOULE AND CHINON: ITS VALUE FOR THE GRAPHITE-REACTOR PROGRAMME. P. Bacher, M. Sagot, P. Tanguy, and A. Teste du Bailler (CEN, Saclay, France). p.515-26 of "Operating Experience with Power Reactors. Vol. I." Vienna, International Atomic Energy Agency, 1963. (In French)

The most important startup tests consisted of progressive replacement experiments, which made it possible to perfect the methods of calculation for G2 and EDF1; fixed absorber and control rod-tests. Through the operation of G2 and G3, a better adjustment of the reactivity balance under power was achieved, taking into account effects of temperature and xenon poisoning. Similarly, experiments carried out with the reactors during operation under power have made it possible to check the validity of the kinetic models used to study transient phenomena in this type of reactor. Results of interest for studies on graphite-natural U reactors are reviewed. (auth)

9683 OPERATING EXPERIENCE WITH POWER REACTORS. VOL. II. Proceedings of the Conference held at Vienna, 4-8 June 1963. (International Atomic Energy Agency, Vienna). Proceedings Series. Oct. 1963. 422p. (STI/PUB/76(Vol.II)). $8.50; Sch 178,50; 51s.stg; F.fr. 34,-; DM 29,75(IAEA)

Separate abstracts were prepared for fifteen of the twenty-two papers on the development, evaluation, containment, staffing, start-up, fuel cycles and handling, and future of power reactors. The other seven papers were previously abstracted in NSA. (D.C.W.)

For abstracts of individual papers see: 9684, 9685, 9686, 9687, 9688, 9689, 9690, 9691, 9692, 9693, 9694, 9695, 9696, 9697, and 9698.

9684 NEUTRON TESTS AT THE START-UP OF EDF 1. A. Teste du Bailler (CEN, Saclay, France) and R. Janin. p.3-31 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963. (In French)

A series of neutron measurements was carried out at the start-up of EDF1 mainly to determine the efficiency of the control rods at different depths of insertion. From them a rod-withdrawal configuration was derived which allowed full-power operation without infringing certain limitations on cladding and gas temperatures. At the same time flux measurements were made for different shim-rod positions and different absorber loadings in certain channels. These measurements based on preliminary two-dimensional calculations, were obtained by activation of point detectors, using the standard technique of air poisoning. At certain temperature plateaus (up to 140°C), measurements of the temperature coefficients and control-rod efficiency were made. Spectrum index measurements were carried out at the same time by activation of appropriate detectors (U, Pu, Lu, Mn, In, Au). The oscillation technique was used to measure the efficiency of certain shim rods. Finally, fast-neutron measurements were made in connection with studies of shielding and graphite damage. (auth)

9685 REVIEW OF EXPERIENCE GAINED AT BERKELEY AND BRADWELL NUCLEAR POWER STATIONS. G. T. Shepherd (Central Electricity Generating Board, Bristol, Eng.) and R. J. Weeks. p.49-62 of "Operating Experience with Power Reactors. Vol. II." Vienna, Internation Atomic Energy Agency, 1963.

An account is given of the general characteristics of the power stations and the experience gained from the period of initial start-up. Certain of the kinetic characteristics are discussed, and information on refueling is presented. (auth)

9686 NOTES ON THE START-UP OF THE LATINA POWER STATION. G. Calabria and G. Gualtieri (AGIP Nucleare, Milan). p.63-82 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The first Italian nuclear power plant, the Latin Power Station is designed for an electrical output of 200 Mw and incorporates a natural uranium-gas-graphite reactor. After a brief description of the main characteristics of the station, details are given on the performance of the final tests of the plant, on the fuel loading, the sequence of commissioning operations, measurements and controls subsequent to the criticality attained. The operations for the start-up and connection of the station to the electrical network are treated. The organization problems relevant to the station operation including personnel preparation and qualification, safety measures, are also illustrated. (auth)

9687 STUDY AND CONSTRUCTION OF THE METAL VESSELS FOR THE REACTORS OF THE EDF 1 AND EDF 2 SECTORS AT CHINON. G. Lamiral, R. Millot, and P. Passérieux (Électricité de France, Clamart). p.85-105 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963. (In French)

The first two natural uranium-graphite-CO_2 reactors at the Chinon station have metal vessels of thick manganese-molybdenum steel plate. The studies carried out on these vessels raised certain problems, particularly in connection with the design and dimensions of the port reinforcements. The reinforcements for the control-rod channels and fuel ports were studied on mock-ups, and the results obtained were checked on the completed reactors during hydraulic tests. The type of construction initially used for the EDF1 vessel was relatively simple. The plates to be welded were locally preheated, and the vessel was not supposed to undergo more than one stress-relief heat treatment after completion of all the welding. Serious cracks developed, however, and it became necessary to alter the whole method of construction. In particular, the welding was now done

after overall preheating and the vessel was subjected to multiple stress-relief treatments. This made it possible to fabricate the vessels for EDF1 and EDF2, but at the same time imposed certain limitations which considerably complicated work on the site. (auth)

9688 THE USE OF PRESTRESSED CONCRETE VESSELS IN THE FRENCH POWER REACTOR PROGRAMME. F. Conte (CEN, Marcoule, France), C. Dambrine, and D. Gaussot. p.107-28 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963. (In French)

The use of prestressed concrete pressure vessels for the Marcoule G2 and G3 reactors and the EDF-3 Chinon reactor is discussed. Problems met in the construction of the vessels and operational experience obtained on the G2 and G3 vessels indicating extreme safety of the vessels are described. The choice of prestressed concrete for the EDF-3 reactor (under construction) and the results of calculations and mock-up tests are also discussed. (D.C.W.)

9689 EFFICIENCY OF THE SHUT-DOWN AND SAFETY EQUIPMENT AND THE KINETIC CHARACTERISTICS OF THE G2 AND G3 REACTORS. C. Henri, J. Plisson, and A. Teste du Bailler (CEN, Saclay, France). p.157-77 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963. (In French)

The experience gained in several years of operating the G2 and G3 reactors confirms that natural uranium-graphite-gas reactors are extremely safe. The built-in shut-down and safety mechanisms incidents are described and their operation is explained by means of diagrams. Power distribution and controlability during accident conditions: distribution of emergency water, and the safety chain are examined. The performance of the installations and the successive improvements incorporated in them are mentioned. The built-in safety characteristics of the reactors are shown by means of an experimental study of their behavior in transient operation. Special attention is given to depressurization accidents, taking into account the performance of the safety device installed. (auth)

9690 MEASUREMENTS OF SHUT-DOWN MARGIN IN WATER AND GAS-GRAPHITE REACTORS: PRINCIPLES AND VALUE OF THE METHOD. E. Iansiti and R. Zambrini. p.179-94 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The principles for determining the shut-down margin in water and gas-graphite reactors and the corresponding measurement techniques are reviewed. These techniques are still not fully worked out, and the methods of calculating and preparing data for the two types of reactor are rather difficult and costly. The problems that need further study are outlined. (auth)

9691 TRAINING AND LICENSING OF REACTOR OPERATORS AT LICENSED POWER REACTORS. F. L. Kelly and D. J. Skovholt (U. S. Atomic Energy Commission, Washington, D. C.). p.197-214 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The regulations and methods used by the USAEC in the licensing of reactor operators at licensed facilities are presented; and data and descriptions on the education, experience, training and licensing of all applicants at 10 U. S. nuclear power stations are given. (auth)

9692 SELNI NUCLEAR POWER STATION ORGANIZATION. SELECTION AND TRAINING OF THE PLANT PERSONNEL. G. d'Arminio Monforte and G. Bertolotti (Società Elettronucleare Italiana, Milan). p.233-43 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The 270-Mw SELNI Enrico Fermi power plant, which uses an advanced pressurized-water reactor, will begin operation in 1964. The organization and training of personnel for operation of the plant are summarized. (D.C.W.)

9693 A SURVEY OF THE FUEL CYCLES OPERATED IN THE UNITED KINGDOM. C. Allday (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). p.269-93 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

Experience in the design, fabrication, performance, transportation, and reprocessing of natural uranium/magnox fuel is outlined. Similarly, the production of enriched uranium oxide fuel for the advanced gas-cooled reactor (AGR) and operating experience with the AGR is treated. The use of plutonium fuel and its effect on costs and the fuel cycle are considered. The place of the AGR and Magnox plants in the United Kingdom power program is indicated. (D.C.W.)

9694 MAGNOX FUEL CYCLES. A. Johnson (United Kingdom Atomic Energy Authority, Risley, Lancs, Eng.). p.295-316 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The interaction between reactivity flux and temperature distributions and irradiation patterns caused by different refueling policies is considered, and present calculation methods outlined. Various refueling schemes for both batch and continuous discharge systems are compared. The problem of the efficient irradiation of the first charge is considered together with delayed onset refueling and shuffling schemes. The economic advantages and problems of using non-natural uranium in flattened reactors are discussed. The practical aspects of on-load refueling schemes for new reactors are considered, and reference experience with the Bradwell and Berkeley powerplants is cited. The effect of the variation of fuel cost and endurance on fuel-cycle economics is outlined. (auth)

9695 FRENCH FUEL ELEMENTS FOR NATURAL URANIUM–GRAPHITE–CO_2 REACTORS: EXPERIENCE GAINED AND FUTURE PROSPECTS. R. Boussard and G. Jeanpierre (CEA, Paris). p.317-36 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The development of fuel elements for natural U-graphite-CO_2 reactor is summarized. Work on materials and on the design and assembly of the fuel elements is reviewed, and experience in the fabrication and use of the fuel elements is considered. (D.C.W.)

9696 APPLICATION AT MARCOULE OF PUNCHED-CARD TECHNIQUES TO PROBLEMS OF PROGRAMMING REACTOR UNLOADING DURING OPERATION. R. Augier de Crèmiers (CEN, Marcoule, France). p.337-49 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963. (In French)

Continuous unloading during operation presents special problems for the unloading program. The yield of the fuel is linked with the homogenization of its irradiation and this in turn is a function of the radial and the axial flux. Axial homogenization of the irradiation depends on the method of unloading. In reactors that can be unloaded during operation it can be achieved under more favorable conditions

than in reactors that must be unloaded during shut-down. In reactors unloaded during operation, radial homogenization of the irradiation results from the execution of an unloading program established per channel—not per zone, as in reactors unloaded during shut-down. The unloading programs are prepared at the Marcoule Centre by a punched-card machine—electronic computer system, which also carries out various accessory operations connected with the functioning of the reactors and control of the fuel. (auth)

9697 POINTING OUT MAIN FACTORS FROM DESIGN, CONSTRUCTION AND OPERATING EXPERIENCE OF EXISTING NUCLEAR PLANTS FOR ASSISTING IN SHAPING FUTURE NUCLEAR POWER PROGRAMMES. F. Dalla Volta (CNEN, Rome). p.353-60 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963.

The first operational Italian nuclear power plants will be Magnox, boiling-water, and pressurized-water stations. Cost data on fuel cycles and plant installation are reviewed for such plants; their trends in recent years and in connection with plant size particularly are noted. Some aspects of plant design related to integration into electricity systems are also examined. (D.C.W.)

9698 EURATOM'S PROGRAMME OF PARTICIPATION IN POWER REACTOR CONSTRUCTION. R. C. Ramadier and E. Parker (Communauté Europienne de l'Énergie Atomique, Brussels). p.369-74 of "Operating Experience with Power Reactors. Vol. II." Vienna, International Atomic Energy Agency, 1963. (In French)

Proposed and proceeding reactor construction is indicated; and the gathering, nature, and distribution of the information that will be acquired is discussed. The associated nuclear industry and fuel element development are also mentioned. (D.C.W.)

9699 CALCULATION OF THERMODYNAMIC SYSTEMS AND OPTIMALIZATION OF GAS TEMPERATURE FOR GAS COOLED NUCLEAR REACTORS. H. Hammer. Thesis, Berlin, Technische Universität, 1962. 110p. $2.00(Gmelin, AED-DISS. 62-499)

The determination of optimum coolant entrance and exit temperatures plays an important role in the design of gas-cooled power reactors. This optimization was calculated for two types of gas-cooled reactors, a Calder Hall reactor with cylindrical fuel elements and a high-temperature BBC-Krupp-type reactor. Various types of secondary systems are used for these calculations. The results indicate that small deviations from the optimum values have practically no influence on the kwh costs. (Gmelin Inst.)

9700 COMPARISON OF THE VALUE OF PLUTONIUM AND URANIUM ISOTOPES IN FAST REACTORS. A. R. Baker and R. W. Ross (Atomic Energy Establishment, Dorchester, Eng.). 38p. (CONF-334-14)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

Upper limits are obtained for the values of Pu^{239} and higher isotopes by estimating those values that will make fuel costs the same as for enriched uranium fuel. When the value of the excess bred plutonium is neglected, Pu^{239} is valued at 1.4 times the value for U^{235} in highly enriched uranium. The excess bred plutonium is taken into account in a study of converter reactors and breeders started up on U^{235}. The value of Pu^{239} is increased to 1.6 times the value of U^{235}. A new treatment of breeding based on a new parameter, the breeding gain, which is shown to be more useful than the breeding ratio usually used. There are also some new calculations of the approach to equilibrium composition for cores fueled initially with Pu^{239} or 99% U^{235} + 1% U^{234}. (auth)

9701 EARTHQUAKE RESEARCH PROBLEMS OF NUCLEAR POWER GENERATORS. G. W. Housner and D. E. Hudson (California Inst. of Tech., Pasadena). 29p. (CONF-359-2)

From American Society of Civil Engineers Annual Meeting, San Francisco, Oct. 1963.

Earthquake problems associated with the construction of nuclear power generators require a more extensive and a more precise knowledge of earthquake characteristics and the dynamic behavior of structures than was considered necessary for ordinary buildings. Economic considerations indicate the desirability of addftional research on the problems of earthquakes and nuclear reactors. The nature of these earthquake-resistant design problems is discussed and programs of research are recommended. (auth)

9702 RELIABILITY IN THE HTGR SCRAM CIRCUITRY. George A. O'Sullivan (Consolidated Controls Corp., Bethel, Conn.). 11p. (CONF-243-41)

From American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, Oct. 1963.

The scram circuitry of the High Temperature Gas-Cooled Reactor is discussed. The reliability of the circuity that combines the outputs from various measurement channels and causes the scram mechanisms to take action on the approach to an unsafe condition is considered. A cost saving technique is presented whereby the number of redundant safety system elements is reduced while the overall system reliability is improved. Diode logic is used exclusively in the safety circuitry because of its desirable fail-safe capability. (C.E.S.)

9703 SUMMARY AND EVALUATION OF STARTUP AND OPERATING EXPERIENCE AT INDIAN POINT STATION. R. H. Freyberg and J. A. Prestele (Consolidated Edison Co. of New York, Inc., New York). 12p. (CONF-357-3)

From National Power Conference, Cincinnati, Sept. 1963. American Society of Mechanical Engineers Institute of Electrical and Electronics Engineers.

A description of the Indian Point Power Station is given along with a summary and evaluation of startup and operating experience. Equipment failures and problems and various corrective measures are also outlined. (C.E.S.)

9704 COMPATIBILITY OF NPD FUEL WITH FUEL HANDLING. J. Pawliw (General Electric Co., Ltd., Peterborough, Ont.). 16p. (CONF-243-45)

From American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, Oct. 1963.

In the NPD fueling process the fuel bundles are loaded into the reactor, pushed through the fuel channels, and discharged from the reactor by remotely operated semi-automatic fueling machines. Examination of 10 commissioning test fuel bundles and 19 partially irradiated fuel bundles resulted in the conclusions that the strength of the NPD fuel bundles is more than adequate to meet the requirements of the on-power fuel handling system, the wear on the wire wraps is sufficiently low so that bundles may be cycled twice through the reactor before discharge—as may be required for reactivity control, and the wear produced in the spent fuel chute is of sufficient magnitude that bundles discharged into the spent fuel bay are unfit for further irradiation. (auth)

9705 MEASUREMENT OF REACTIVITY AND POWER THROUGH NEUTRON DETECTION PROBABILITIES. Donald H. Bryce (Cornell Univ., Ithaca, N. Y.). 25p. (CONF-332-7)

From Symposium on Noise Analysis in Nuclear Systems, Gainesville, Fla., Nov. 1963.

The time dependent probability for detection of a prompt thermal neutron following the detection of a neutron at some arbitrary origin of time is developed. It is shown that it is possible to measure reactivities and estimate reactor power through methods based on measurements of this probability. It is shown how earlier experiments designed to measure the Rossi alpha were limited to fast reactors and how this limitation may be removed. A method for measurement of the Rossi alpha from subcritical observations is also developed. (C.E.S.)

9706 NUCLEAR POWER ENGINE. Helmut Braun and Andreas Setzwein (Brown, Boveri & Cie AG). German Patent 1,156,903. Sept. 7, 1963. Filed Aug. 8, 1959.

The power engine described comprises a nuclear reactor, a closed primary circuit with a pressurized coolant medium that expands in a turbine and is recirculated through the core by a compressor, and a pressure vessel, which encloses these parts. The turbine and compressor are located on opposite faces of the core, and the turbine is connected with the compressor directly by a hollow shaft through which part of the primary coolant is circulated for bearing purposes. In the ring-shaped space between the surface of the core and the wall of the pressure vessel there are heat exchanger elements cooled by a secondary coolant medium. (Gmelin Inst.)

Production Reactors

9707 (HW-79022) N-REACTOR PROCESS TUBE ROLLED JOINT STEP REMOVAL. Interim Report. J. H. Fastabend (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Sept. 30, 1963. 17p. Contract AT(45-1)-1350.

The rolled joint of the N-reactor process tube assembly presents edges and step-ups along the fuel charging path. In order to minimize damage to fuel element supports, the development of tools to minimize or reduce these steps was initiated. The status of the tool development program is reported. Three short-term and two long-term methods and the hazards in each method are evaluated. It is concluded that rolled joint step elimination should be carried out after reactor startup. (D.L.C.)

9708 (HW-79316) COMPARISON OF LITHIUM HYDROXIDE AND AMMONIUM HYDROXIDE FOR N-REACTOR PRIMARY SYSTEM COOLANT pH CONTROL. W. K. Kratzer (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 23, 1963. Contract [AT(45-1)-1350]. 5p.

From the standpoint of general uniform corrosion and crud formation during routine equilibrium reactor operation, lithium hydroxide and ammonium hydroxide are equivalent. Increased damage to the corroded steam generator tubes resulting from lithium hydroxide concentration in the defects is unlikely, but possible. Ammonium hydroxide would not concentrate in such defects. Initial operation of a clean, unfilmed reactor primary system with lithium hydroxide should not produce excessive crud attributable to the pH control material. Initial operation with ammonium hydroxide has not been evaluated. The principal unresolved problem associated with the use of lithium hydroxide, potential damage to the steam generator tubes, cannot be monitored or detected until the damage has occurred. The principal unresolved problem associated with the use of ammonium hydroxide, potential crudding in an unfilmed system, can be monitored and corrective action taken as the problem develops. (auth)

9709 (HW-79356) FABRICATION AND TESTING OF A THORIUM ALLOY CORE THERMOCOUPLE ELEMENT FOR USE AS A FUEL FOULING DETECTOR IN N-REACTOR. L. E. Kuhlken (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 24, 1963. Contract AT(45-1)-1350. 8p.

To protect the fuel in the N-reactor from excessive crud deposition, a thermocoupled fuel rod was designed to monitor temperature drops arising from crud deposition on the fuel element surfaces. The design is the fourth in a series of designs and is the same as the third design except for the replacement of the fuel by a Th–1.5% enriched U–1.0% Zr alloy. The Zircaloy-2-sheathed thermocouples are sealed into the rod and end cap by a Zr–5% Be braze, and the assembled rod is supported in a Zircaloy-2 sleeve. The fabrication of the rod is described. Results of pre-irradiation testing are given. (D.L.C.)

9710 FOR A NUCLEAR LOOP: GAS BEARINGS. E. C. Bennett (General Electric Co., Richland, Wash.). Mech. Eng., 85: 26-9(June 1963).

The development of gas-lubricated bearings for the gas circulators in the coolant system of the DR reactor at Hanford is described. (C.E.S.)

Propulsion and Space

9711 (63SD235) VEHICLE DESIGN RELATED TO SYSTEM CONSIDERATIONS FOR NUCLEAR/ELECTRIC SPACECRAFT. K. G. Hagen and L. I. Lady (General Electric Co. Missile and Space Div., Valley Forge Space Technology Center, King of Prussia, Penna.). Mar. 1, 1963. 47p. (X63-13565)

A parametric approach to configuration design for nuclear-electric space vehicles is presented. Major system parameters are identified relating the radiator and nuclear shield to the spacecraft and to each other. Using these parameters, nomograph type charts are developed that permit first cut trade-offs to be made in system evaluation. (auth)

9712 (CONF-311-9) DESIGN AND SAFETY ASPECTS OF HYDRIDE-FUEL SNAP REACTORS. D. J. Cockeram and R. L. Detterman (Atomic International. Div. of North American Aviation, Inc., Canoga Park, Calif.). [nd]. 18p. Contract AT(11-1)-Gen-8.

From American Nuclear Society, Aerospace Nuclear Safety National Topical Meeting, Albuquerque, N. Mex., Oct. 1963.

The general optimization for the reactor designs using uranium–zirconium hydride (SNAP-10A, 2, and 8) is described. The inherent features which determine the physical characteristics of the system and the safeguards for criticality protection during shipping and handling are discussed. (D.L.C.)

9713 (CONF-375-3) NUCLEAR MATERIALS FOR SPACE APPLICATIONS. Socrates S. Christopher (Atomic Energy Commission, Washington, D. C.). [1963]. 37p.

From 6th National Symposium, Society for Aerospace Material Process Engineers, Seattle, Nov. 1963.

The results of investigations on the suitability of Nb, Ta,

and W alloys as cladding materials for nuclear space applications are discussed, together with the properties of the nuclear fuels UC, UO_2, and UN. The merits of cermet fuels are also considered. A thermionic nuclear power conversion system is described, and evaluation results on the compatibility of the refractory metals, (emitter materials) with UC, UC_2, UO_2, and UC–ZrC at 1800 to 2000°C are summarized. (D.C.W.)

9714 (NP-13468) A SUMMARY OF DOUGLAS RESEARCH IN ADVANCED PROPULSION SYSTEMS. (Douglas Aircraft Co., Inc., Santa Monica, Calif.). June 1962. 52p. (SM-41961)

Gaseous core and nuclear electric reactor systems, which promise improved propulsion system performance by circumventing the temperature limitations of materials, are being investigated. The research and problems associated with the two concepts are discussed; and research on radiation shielding, nuclear propulsion system dynamics, and propellant behavior in zero gravity is summarized. (D.C.W.)

9715 (SC-DC-3553(p.65-78)) SNAP REACTOR TRANSIENT TESTS. L. I. Moss (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.) and T. R. Wilson (Phillips Petroleum Co., Idaho Falls, Idaho).

The SNAP reactor transient testing program (SNAP-TRAN) is discussed. Typical input parameters used in the calculations are given. 14 references. (R.E.U.)

9716 (SC-DC-3553(p.103-27)) NUCLEAR SAFETY OF ADVANCED NUCLEAR SPACE POWER PLANTS NON-BOILING LITHIUM-COOLED REACTOR. D. L. Cochran, J. P. Lehman, and G. H. Anno (Aerojet-General Nucleonics, San Ramon, Calif.).

A 300-kw(e) reactor is analyzed in which the fuel consists of 100 kg of fully enriched uranium carbide pins. The reactor is cooled by nonboiling lithium and operates at a nominal temperature of 2000°F. The pressure vessel and other structural components in contact with the lithium are also made of Nb–Zr. The reactor is suitable as a heat source for an alkali-metal, Rankine cycle, power-conversion system or an out-of-pile direct conversion system. The operational sequence and possible accidents are analyzed. Excursion yields during launch operations and radiation hazards, including fission-product release, are discussed for the nuclear space power system. Reentry problems are considered. 34 references. (R.E.U.)

9717 (SC-DC-3553(p.131-43)) SAFETY OF RIFT VEHICLE LAUNCH AND FLIGHT OPERATIONS. R. C. Hock ([Sandia Corp., Albuquerque, N. Mex.]).

The RIFT vehicle, typical trajectories, prelaunch, launch, and flight operations, and their related safety considerations are described, based on current planning. (R.E.U.)

9718 (SC-DC-3553(p.155-65)) ROVER REACTOR TRANSIENT ANALYSES. W. R. Stratton and C. G. Chezem (Los Alamos Scientific Lab., N. Mex.).

The methods used and the current capabilities for estimating the power history, fission energy release, and dynamic behavior of a Kiwi-B4 reactor when it is subjected to abnormal changes of reactivity are reported. Conceptual accidents that are considered arise from assumed malfunction of the control vanes, the lack of complete reflection (immersion in water), the undermoderated character of the core (water or liquid-hydrogen flooding), and the existence of void space in the core (compaction following impact on concrete or implosion within chemical propellants). A special and related case is that of the purposeful destruction of the reactor in orbit about the earth following full power operations. The philosophy adopted was to find a means to describe a generalized accident and use this to provide a framework within which each accident type with its special characteristics may be fitted. The digital computer codes employed are the well-known RTS, which numerically integrates the neutron kinetic equations, and the relatively new RAC, which, though not completed, is designed to follow changes in the core geometry and physical state of the material. (auth)

9719 (SC-DC-3553(p.167-79)) FLIGHT OPERATIONAL SAFETY SYSTEMS FOR NERVA. R. I. Unger (Aerojet-General Corp., Azusa, Calif.).

The objectives and operation of the anticriticality safety system are discussed. Two designs are considered: a destruct system to disperse core fragments into subcritical geometry and a poison insertion system for subcriticality. A postoperational safety system to disperse the reactor core and core-retained fission products to prevent health hazards is described. (R.E.U.)

9720 NUCLEAR NAVAL PROPULSION. Franco Spinelli (Università, Naples). Energie Nucl., 5: 533-7 (Nov. 1963). (In French)

Costs and economic characteristics of merchant-ship nuclear power plants are outlined. Future prospects for this application of nuclear power are discussed. The domain in which nuclear power is most competitive with conventional power is denoted. (T.F.H.)

9721 NEW PROPULSION SYSTEMS. H. Loeb (Universität, Giessen, Ger.). Kerntechnik, 5: 475-96(Dec. 1963). (In German)

Nuclear and solar energy propulsion systems are discussed. A survey is presented of unconventional propulsion systems including chemical rockets, nuclear and solar thermal rockets, electrical systems, the possibilities of producing electric power in space, the radioisotope rocket, and the photon rocket. (R.E.U.)

9722 INTERPLANETARY MISSIONS CONFERENCE NINTH ANNUAL AMERICAN ASTRONAUTICAL SOCIETY MEETING STATLER HILTON HOTEL/LOS ANGELES, CALIFORNIA, JANUARY 15-16-17, 1963. R. B. Dillaway and A. G. Negro (Rocketdyne, Canoga Park, Calif.). 25p. (CONF-379-1)

From Interplanetary Missions Conference 9th Annual American Astronautical Society Meeting, Los Angeles, Jan. 1963.

Reasons behind the need for nuclear rockets, together with the potential uses of these rockets in complex space vehicles are explored. Vehicle performance requirements for future space programs are bounded. The booster systems now planned or under consideration by the United States are outlined. Various combinations of all-chemical systems are compared with nuclear-chemical systems in terms of performance capability. Nuclear system requirements for these applications are discussed. Payload delivery cost estimates are made, based upon a series of assumptions concerning vehicle makeup and component costs experience. The advantages of nuclear propulsion systems with regard to cost and performance are presented. Allowable research and development engine unit-costs which would make the nuclear engine systems competitive with other systems are summarized. (auth)

9723 OBSERVED AND PREDICTED PERFORMANCE OF THE N. S. SAVANNAH POWER CORE 1. A. E. Paulson and W. R. Smith (Babcock and Wilcox Co., Lynchburg, Va.). 21p. (CONF-360-8)

From American Nuclear Society Topical Meeting Nuclear

Performance Power Reactor Cores, San Francisco, Sept. 1963.

Measurements of core excess reactivity, flux and power distribution, control rod group and pattern worths, and power peaking values for various control rod patterns are given for the N. S. Savannah Power Core 1. (C.E.S.)

9724 IMPROVEMENTS IN AND RELATING TO PRESSURIZED WATER NUCLEAR REACTOR PLANTS. (to Reactor Centrum Nederland). British Patent 946,885. Jan. 15, 1964. Priority date Jan. 26, 1961, Netherlands.

A pressurized-water reactor is described in which the water acts both as coolant and moderator. The design is for a compact reactor with relatively high thermal efficiency, so that, for example, it is suitable for propelling vessels. It is characterized by the provision of at least one jet pump within the casing, the jet tube of which is so directed that it recirculates some of the water in the casing through a path consisting of the core and the space at the sides of the core. As a result of this construction, the rate of flow through the core is greater than the flow through the high-temperature circuit of the heat exchanger. Therefore it is possible to reduce the size of the outer part of the circuit and a smaller circulating pump may be used. (M.C.G.)

Research and Test Reactors

9725 (HN-172(Vols.I & II)) A STUDY OF TEST REACTOR OPERATING AND SAFETY EXPERIENCE. B. J. Garrick, W. J. Costley, and W. C. Gekler (Holmes and Narver, Inc., Berkeley, Calif.). May 10, 1963. Contract AT(04-3)-424. 460p.

Issued in two volumes, but cataloged as a unit.

A study of the operating experience of existing test reactors is made to obtain a better understanding of reactor safety. The test reactors studied are ETR, MTR, ORR, GETR, and Westinghouse Testing Reactor. The emphasis in this study is on factual experience information contained in records and discussions. Both administrative and technical experience is covered, and the training programs are discussed. Protective systems and unscheduled power reductions are discussed. (D.L.C.)

9726 (HW-69724) LIGHT WATER INJECTION INTO PRTR PRIMARY COOLANT SYSTEM. W. D. Richmond (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). May 25, 1961. Contract AT(45-1)-1350. 8p.

At approximately 11:13 p.m. on May 6, 1961, 800 lb of light water leaked into the heavy water system owing to the partial opening of a valve. The background of the incident is described. The probable causes of the incident are outlined, and recommendations are made for avoiding such incidents in the future. (D.L.C.)

9727 (HW-SA-3008) IN-REACTOR MONITORING OF THE ZIRCALOY-2 PRTR PRESSURE TUBES. D. R. Doman and P. J. Pankaskie (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 1, 1963. Contract AT(45-1)-1350. 13p. (CONF-187-17)

From American Nuclear Society Meeting, New York, Nov. 1963.

A surveillance program was initiated to determine the actual operating performance of the Zircaloy-2 PRTR pressure tubes. The program included in-reactor inspection and pre- and post-irradiation destructive testing, and the equipment for the in-reactor inspections is described. The results of 2½ years' evaluation of pressure tube performance are summarized. Fretting/wear corrosion marks were found, but they had no effect on tube strength. In general, the Zircaloy-2 pressure tubes gave acceptable performance. (D.L.C.)

9728 (HW-SA-3232) OPERATING CHARACTERISTICS OF THE GAS-BEARING COMPRESSORS OF THE PRTR GAS-COOLED LOOP FACILITY. D. P. Schively (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 11, 1963. Contract AT(45-1)-1450. 9p. (CONF-251-5)

From Rotating Machinery for Gas Cooled Reactor Application, Gatlinburg, Tenn., Nov. 1963.

The PRTR gas-cooled loop facility was constructed for investigating graphite–CO_2 equilibria. A brief description is given of its compressors, which were built by Bristol Siddeley Engines Ltd., and their operating characteristics. The compressors are of the hydrodynamic gas bearing type, single stage, with radial vaned impeller. The results of test runs and the performance to date are given. (D.L.C.)

9729 (IDO-16886) NON-DESTRUCTIVE AND DESTRUCTIVE TRANSIENT TESTS OF THE SPERT I-D, FULLY ENRICHED, ALUMINUM-PLATE-TYPE CORE: DATA SUMMARY REPORT. M. R. Zeissler (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Nov. 27, 1963. Contract AT(30-1)-205. 69p.

This report is a documentation of the experimental data from each test of the series performed in the Spert I reactor with the type D, fully enriched, aluminum plate-type core. The series of tests consisted of step-wise insertions of excess reactivity under conditions of ambient temperature and atmospheric pressure. The data obtained from each test are presented in tabular form and as plots of the time behavior of reactor power, fuel plate surface temperature, and pressure. Composite figures, displaying the behavior with time, of fuel plate temperatures and pressures at various positions in the reactor are included. Correlated data figures displaying measured test data as functions of asymptotic reactor period are also included. (auth)

9730 (NP-13485) THE HAWKER-SIDDELEY IN-PILE CREEP TEST FACILITY. (Hawker Siddeley Canada Ltd., Toronto). Oct. 1961. 12p.

An in-pile creep test facility was developed for the creep testing of Zircaloy-2 in the NRX Reactor at Chalk River. The facility, instrumentation, and installation are described. Sample in-pile and out-of-pile creep curves are given. (D.L.C.)

9731 (SC-4966(RR)) SAFETY ANALYSIS OF THE SANDIA NUCLEAR ASSEMBLY FOR REACTOR EXPERIMENTS (SNARE). C. B. Becherer and R. G. Tackett (Sandia Corp., Albuquerque, N. Mex.). Jan. 1964. Contract AT(29-1)-789. 80p.

An analysis of the hazards associated with the proposed operation of the Sandia Nuclear Assembly for Reactor Experiments (SNARE) is presented. Descriptions of the reactor and facility, considerations of the reactor site in relation to hazards to the public, evaluations of safety factors, and a description of supervisory practices and operating procedures are included. (auth)

9732 (TID-19943) A GRAPHITE SUBCRITICAL REACTOR LABORATORY FOR NUCLEAR ENGINEERING. (Kansas State Univ., Manhattan). [1962]. Contract AT(11-1)-1125. 274p.

The design and constructional methods for a graphite subcritical assembly and the instrumentation of a basic

nuclear engineering laboratory centered about this assembly are presented. References, object, method, and procedure are also given for experiments on counting statistics, isotope buildup, cadmium ratio, Fermi age, diffusion length, measurements of effective pile size, critical size and effective multiplication factor, and electronic circuitry for nuclear detection. (C.E.S.)

9733 (EURAEC-781) OSCILLATION OF URANIUM SLUGS IN "MARIUS." Special Report No. 12, July–August 1962. O. Tretiakoff, J.-C. Carre, M. Robin, and R. Vidal (France. Commissariat à l'Énergie. Centre d'Études Nucléaires, Fontenay-aux-Roses). June 1963. Work Performed under United States–Euratom Joint Research and Development Program. Contract 3742. 75p. (A translation)

Oscillation experiments were carried out to study the nuclear properties of fissile materials. The method, experimental conditions, and instrumentation for the experiments are described. The results and their interpretation are discussed. (D.L.C.)

9734 DESCRIPTION AND OPERATION OF THE OSCILLATOR FOR THE AGN-201 REACTOR OF THE UNIVERSITY OF PALERMO. A. Sellerio, G. Greco, E. Oliveri, E. Sinagra, and M. C. Spitale (Università, Palermo, Italy). Atti Accad. Sci., Lettere Arti Palermo, Pt. I, 22: (1961-62) (Pub. 1963). (In Italian)

A description is given of the pile oscillator designed for the experimental reactor Costanza for the purpose of cross section determinations by local or total oscillations of the neutron density. The severe sinusoidal motion of the sample to be examined causes a periodic disturbance in the reactor. The frequency of the motion can be selected. The reactor's response, elaborated by the electronic device and strongly filtered, becomes also sinusoidal with the same frequency. The results are shown in a digital manner. The sinusoidal curves for scattering and for absorption must have the same zeros in agreement with the experiments made; however, it is possible to discriminate the two effects and get measures separately. (auth)

9735 URANIUM-OXIDE GRAPHITE-MODERATED SUBCRITICAL EXPERIMENTS. [PART] II. Toyohiko Kikuchi and Ryushi Kubota (Fuji Electric Mfg. Co., Ltd., Japan). Fuji Jiho, 36: 706-12(Aug. 1963). (In Japanese)

Experimental results on material bucklings and extrapolation distances for various lattices and fuel arrangements are reported. The results are compared with theoretical values calculated by simple but realistic models. By use of the experimental results on material buckling, the number of neutrons per absorption in fuel η and the effective resonance integral is reduced. (auth)

9736 ENERGY SPECTRA OF SLOW NEUTRONS EMITTED FROM A VVR-C HORIZONTAL CHANNEL. R. B. Begzhanov, D. A. Gladyshev, S. V. Starodubtsev, and T. Khaidarov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Izv. Akad. Nauk Uz. SSR, Ser. Fiz.-Mat. Nauk, No. 3, 23-8(1963). (In Russian)

A mechanical neutron selector with a horizontal rotor capable of measuring total neutron cross sections at >10 kev was used for measuring neutron spectra in a horizontal channel. Measurements at various reactor powers and various selector channel widths showed that the slow neutron spectrum has a Maxwell distribution only between 0.75 and 1.5 Å. Dips in the observed spectrum result from resonance absorption in U^{238} at 0.062 and 0.11 Å. A considerable reduction in flux was observed in the regions of U^{235} resonances 0.268 and 0.53 Å. Distortion of the spectrum in the 0.04 to 0.5 Å region was a result of selector resolution. (R.V.J.)

9737 "TITAN"–A NUCLEAR ASSEMBLY. Eiichi Takeda (Tokyo Inst. of Tech.) and Shigeru Mizuno. Mitsubishi Denki Giho, 37: 1126-33(Sept. 1963). (In Japanese)

The nuclear assembly Titan provides extremely flexible facilities built on a new concept and embodies a subcritical assembly and basic research devices integrated in nuclear reactor physics and engineering. The principal objectives of the installation are studies on enriched uranium-fueled, light water-moderated and -reflected heterogeneous systems. On the other hand the instrumentation and central system and the safety channel for training in reactor operation are provided. Triple safety actions such as accelerated insertion of control rods, damping of moderator, and void formation in the core are available. The assembly is now ready for being fueled. (auth)

9738 BRISEIS. TRANSIENT REACTOR FOR FAST REACTOR FUEL TESTING. Cl. Descamps, E. Fossoul, N. Meyvaert, M. Stiévenart, G. Tavernier, and J. Van Dievoet. 16p. (CONF-334-6)

From Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., Oct. 1963.

The neutron characteristics of BRISEIS are discussed. A 19-pin assembly of PuO_2–UO_2 with 12%-Pu enrichment, used in fast reactors, was tested on the axis of the cylindrical transient reactor. It is concluded that the high thermal capacity of a homogeneous graphite drive core and the space and time behavior of the neutrons can be used successfully in the design of a reactor suitable for transient testing of highly absorbing fuel in a loop. (R.E.U.)

9739 THE RESEARCH REACTOR AS A GAMMA SOURCE. William F. Hall, Charles C. Thomas, and Ralph F. Lumb (Western New York Nuclear Research Center Inc., New York). 15p. (CONF-243-43)

From American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, Oct. 1963.

Two mechanisms for generating intense gamma sources in research reactors are discussed. The mechanisms include the reactor fuel itself after operation in the core and a loop containing a liquid with a high activation cross section and a short half life, which is continuously activated by exposure to the high neutron flux in the proximity of the reactor core. (C.E.S.)

9740 OPERATIONAL PROBLEMS OF THE GETR. W. N. Lorentz and H. J. Larson (General Electric Co., Pleasanton, Calif.). 21p. (CONF-243-42)

From American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, Oct. 1963.

Equipment failures and problems associated with the General Electric Test Reactor and their impact on the reactor operation are discussed. Failures in the loop heater, capsule, primary loop lateral piping, reactor primary and pool coolant heat exchanger, biological shield cooling coil and control rod problems are reported. (C.E.S.)

WASTE DISPOSAL AND PROCESSING

9741 (CEA-2353) ESSAIS DE DECONTAMINATION PAR VOIE ELECTROLYTIQUE DE PLAQUETTES EN ACIER INOXYDABLE NS 22 S. (Decontamination Tests Using an Electrolytic Method on NS 22 S Stainless Steel Discs). P. Boutot and P. Schipfer (France. Commissariat à l'Energie Atomique. Centre de Production de Plutonium de Marcoule, Chusclan). 1963. 41p.

These tests were carried out with a view to observing the results obtained by using electrolytic polishing for the decontamination operations. The experimental equipment consists essentially of a current rectifier and adjuster, and of an electrolytic cell fitted with an automatic system for thermal regulation and agitation. The samples made of type NS 22 S stainless steel were contaminated with an active solution of fission products. The activity of the discs is measured before and after each treatment using a bell counter. For each electrolyte, the parameters studied are: the time, reactant concentration, temperature, current density, and corrosion. Taking into account the necessity of transforming as little as possible the surface of the part to be treated, the best results are generally obtained using intermediate concentrations of the reactant, low temperatures, and high current densities. (auth)

9742 (HW-SA-3233) FIXATION OF RADIOACTIVE FISSION PRODUCTS ON INORGANIC ION EXCHANGE MEDIA. W. V. DeMier (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Oct. 16, 1963. Contract AT(45-1)-1350. 21p. (CONF-196-2)

From Electron Microscope Meeting, Denver, Colo., Aug. 1963.

The in-container ion exchange process was selected for storing cesium and strontium from high-level radioactive wastes at Hanford. The steps of the ion exchange-based packaging process are outlined, and the properties and capacities of several zeolite exchangers are given. The hot-through-gas technique was selected for dehydrating the bed in the storage container prior to storage, and drying rates were determined using air at 800°F. Off-gas moisture measurement is considered. The pressure drop, off-gas particulates, and thermal conductivity of the bed were studied. The problem of sizing the container for adequate heat removal is considered. (D.L.C.)

9743 A REVIEW OF THE LITERATURE OF 1961 ON WASTEWATER AND WATER POLLUTION CONTROL. D. A. Okun, C. M. Weiss, T. A. Alspaugh, et al. J. Water Pollution Control Federation, 34: 525-64(June 1962).

The literature of 1961 on water pollution control is reviewed. Emphasis is placed on methods for the treatment of industrial wastes including radioactive wastes. 360 references. (C.H.)

9744 WASTE DISPOSAL. Reactor Fuel Process., 6: No. 4, 39-52(1963).

Developments in liquid-waste treatment by ion exchange and foam separation are discussed. Methods of converting high-level-activity wastes to solids by spray calcination and pot calcination are described. Engineering, economic, and safety evaluations of interim storage of calcined wastes in water-filled canals are presented. The feasibility of waste disposed by hydraulic fracturing into shale is discussed. Tests of Wyoming bentonite as a cover material for preventing the leaching of buried solid wastes are described. The CSREX solvent-extraction process for separating fission products from Purex process waste is described along with improvements in other methods. (34 references) (M.C.G.)

GENERAL AND MISCELLANEOUS

9745 (ABCC-24-62) CASE REPORTS—1962. Gen Niwayama (Atomic Bomb Casualty Commission, Hiroshima). Contract AT-49-1-GEN-72. 37p.

Separate abstracts were prepared for the two papers included. Both present autopsy findings for patients with rare pathological conditions. (C.H.)

For abstracts of individual papers see: 9746 and 9747.

9746 (ABCC-24-62(p.1-23)) CYTOMEGALIC INCLUSION DISEASE OF THE SUBMAXILLARY GLAND. CASE REPORT AND REVIEW OF LITERATURE. (Atomic Bomb Casualty Commission, Hiroshima).

The case history and autopsy finding are presented for a case of cytomegalic inclusion disease in the salivary gland of a 5-month-old male infant. The relation of viruses to cytomegalic inclusion disease is discussed briefly. (C.H.)

9747 (ABCC-24-62(p.25-34)) ETIOLOGIC FACTORS IN OBSTRUCTION OF THE SUPERIOR VENA CAVA. (Atomic Bomb Casualty Commission, Hiroshima).

The etiologic factors in obstruction of the superior vena cava and pathologic alterations involving the superior vena cava in a group of cases that came to necropsy are discussed. (C.H.)

9748 (BNL-7557) THE ACTIVE CENTER IN ENZYME ACTION. D. E. Koshland, Jr. (Brookhaven National Lab., Upton, N. Y.). [1963]. Contract (AT(30-2)-Gen-16]. 23p. (CONF-376-1)

For Presentation at the 50th Anniversary Celebration of French Biochemical Society, Paris, Apr. 1964.

The role of amino acids at the active center of an enzyme in the catalytic function of the enzyme is discussed. Results are reported from modification studies on chymotrypsin that illuminate the role of tyrosine residues and the role of serine in chymotrypsin action. (C.H.)

9749 (GAT-484) HISTORY OF COOLING TOWERS AT THE PORTSMOUTH AREA DIFFUSION PLANT. D. B. Jones (Goodyear Atomic Corp., Piketon, Ohio). May 7, 1963. Contract AT(33-2)-1. 19p.

A review is presented on conditions under which the cooling towers have operated and maintenance history. The relation between operating conditions and maintenance requirements, where they are of special significance, are shown when possible. Areas in which the design of future towers might be improved are also discussed. (P.C.H.)

9750 (HW-68600-34) PLUTONIUM ABSTRACTS. Vol. 3, No. 12. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Jan. 1, 1964. Contract AT(45-1)-1350. 19p.

A total of 24 references, most in abstracted form, is presented on new developments in plutonium technology. The references are arranged into the following subject fields: chemistry, health and safety, metallurgy and ceramics, physics, reactor technology, and miscellaneous. (D.L.C.)

9751 (HW-SA-3280) A GEOPHYSICAL SEISMIC EVALUATION STUDY AT THE HANFORD WORKS, WASHINGTON. R. E. Brown and J. R. Raymond (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 2, 1963. Contract AT(45-1)-1350. 18p. (CONF-377-1)

From the Annual Meeting of Northwest Scientific Association, Spokane, Dec. 1963.

A geophysical seismic research study was conducted in the Hanford Works area to determine the applicability of seismic techniques for studying movements of ground water. The surfaces of the basalt and the Ringold Formation were detected, but the ground water table was not detected because it lay within the Formation. Features lying beneath the basalt surface (interbeds, faults, and base of basalt series) could not be probed. The performance of rotary drills is compared with that of cable-tool drills. (D.L.C.)

9752 (IA-900) RESEARCH LABORATORIES SEMI-ANNUAL REPORT FOR THE PERIOD JANUARY–JUNE 1963. (Israel. Atomic Energy Commission. Soreq Research Establishment, Rehovoth). 184p.

Research and development activities are reported and summarized. Information is included on the operation of the IRR-1, radioisotope production, fallout, neutron sources, radiation hazards protection, general physics, high-energy nuclear physics, elementary particle theory, reactor physics, nuclear physics, solid state physics, atomic physics, inorganic chemistry, radiation chemistry, nuclear chemistry, analytical chemistry, radiobiology, biology and medicine, environmental studies, electronics, mechanical instrumentation, published papers and reports, administration, and health physics. (N.W.R.)

9753 (IDO-10037(Rev.1)) MANUAL FOR OPERATIONAL DOCUMENTARY PHOTOGRAPHY (ODP). V. V. Hendrix (Idaho Operations Office, AEC). Dec. 23, 1963. 23p.

The SL-1 incident showed the need for pre-incident photographs of the facility to aid in rescue or recovery operations. A system of documentary photographic coverage was developed to fill this need for all the NRTS reactors and facilities. In this system, aperture cards with photographic negatives are used, and the cards are coded with respect to facility, room, floor, angle, and other variables. Operational planning for documentary photographs and updating of the cards are discussed. (D.L.C.)

9754 (KAPL-M-EC-33) GEM—A GENERAL MATRIX MANIPULATION PROGRAM FOR VIBRATION STUDIES. James A. Warrington (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 12, 1963. Contract W-31-109-eng-52. 27p.

The computer program GEM performs the operations of VEP (finding the natural frequencies and mode shapes of an undamped vibrating mass-spring system for which the mass and stiffness matrices are known), computes static forces as in SHO, and performs general matrix operations. (D.C.W.)

9755 (KAPL-M-EC-36) LIZARD—A PROGRAM TO SOLVE NON-LINEAR, ORDINARY DIFFERENTIAL EQUATIONS. David L. Briggs and Joseph R. Schmid (Knolls Atomic Power Lab., Schenectady, N. Y.). Oct. 22, 1963. Contract W-31-109-eng-52. 23p.

The computer program LIZARD for solving nonlinear ordinary differential equations is described. The program can handle up to fifteen first-order equations. Higher order equations must be reduced to first order by the substitution of new dependent variables. The input is in the form of numerical operations. Up to fifteen algebraic

operations and six driving functions are available. Several examples are included. (auth)

9756 (KAPL-M-LD-9) SHOCK MACHINE ANALYSIS. L. Deagle and J. K. Van Voorhis (Knolls Atomic Power Lab., Schenectady, N. Y.). Oct. 1963. Contract W-31-109-eng-52. 23p.

A computer program is presented which can be used to calculate the response of structures mounted on the Navy Shock Machines. The Philco-2000 Digital Computer is used to compute the shock response for the initial hammer blow and for the first rebound from the table stop. The solution for the free vibration problem is required as input for the code. The effects of damping on the shock response have been neglected. (auth)

9757 (KAPL-M-TL-1) BIBLIOGRAPHY ON COMPRESSED AIR SYSTEMS–SAFETY CONSIDERATIONS (SELECTED REFERENCES). Helyn Walton, comp. (Knolls Atomic Power Lab., Schenectady, N. Y.). Oct. 1963. Contract W-31-109-eng-52. 14p.

References (170) are included for articles on various safety considerations for hydraulic and compressed-air systems. (D.C.W.)

9758 (LAMS-3011) SELECTED CONTRIBUTIONS TO HIGH-PRESSURE RESEARCH FROM THE LOS ALAMOS SCIENTIFIC LABORATORY. Barbara L. Hendry, comp. and ed. (Los Alamos Scientific Lab., N. Mex.). Dec. 9, 1963. Contract W-7405-eng-36. 30p.

A bibliography of 175 references is presented. (D.L.C.)

9759 (NYO-10700) A STUDY OF PLANKTON NUTRITION AND ANTIBIOSIS USING RADIOISOTOPES UNDER VARYING ECOLOGICAL CONDITIONS. Final Report, January 1, 1962–December 31, 1961. Raymond G. Stross (Maryland, Univ., College Park). Contract AT(30-1)-2446. 42p.

Results are reported from a study of factors affecting the growth of phytoplankton in fresh-water lakes. Emphasis was placed on the effect of nutrient exchange with bottom sediments and the effect of browsers of phytoplankton, primarily herbivorous crustacea, on nutrient utilization. (C.H.)

9760 (SC-DC-3568) MEMORY SYSTEMS STUDY. Annual Report No. 2, November 16, 1962 to November 15, 1963. G. R. Peterson, R. C. DeVries, and J. L. Melsa (Arizona. Univ., Tucson. Engineering Research Lab.). For Sandia Corp., Albuquerque, N. Mex. Contract AT(29-1)-789. 80p.

Results of theoretical studies of learning control systems are presented. The need for definitions is discussed and definitions of successful, adaptive, and learning control systems are presented. The basic structural elements of learning control systems are discussed. The environmental characteristics of control situations in which learning may be applicable are discussed. Learning control systems are classified in accordance with the environmental situation in which they might operate. The structure and components suitable to various environmental situations are discussed. (auth)

9761 (SC-DR-251-63) PRELIMINARY REPORT ON THE DEVELOPMENT OF A NONDESTRUCTIVE TEST FOR BRIDGEWIRES. L. J. Klamerus and J. D. Stewart (Sandia Lab., Albuquerque, N. Mex.). Nov. 1963. Contract AT(29-1)-789. 15p.

Tests have been performed in an effort to develop techniques for testing the integrity of bridgewire welds. The test methods employed in this project were r-f fault detection, thermal fatigue, and infrared sensing. Infrared sensing has shown the most encouraging results. (auth)

9762 (SC-TM-102-63(24)) A FIXED WATER-VAPOR PRESSURE GENERATOR. J. L. Hartley (Sandia Lab., Albuquerque, N. Mex.). Apr. 1963. Contract AT(29-1)-789. 8p.

An apparatus designed to generate a fixed water-vapor pressure is described. A dew-point hygrometer was used to evaluate the generator's capability. Test results indicate that the generator will provide a fixed dew point to within ±0.113°C. (auth)

9763 (SC-TM-293-63(13)) ZERO SPRING-RATE MECHANISM. T. D. Herther (Sandia Lab., Albuquerque, N. Mex.). Jan. 1964. Contract AT(29-1)-789. 19p.

A description is given of the work done in an effort to find a spring with a constant negative spring rate. When the constant negative spring rate is matched to a positive spring rate, a zero spring rate is the result. This type of system then has a displacement step at a settable force level. A system of this nature could be used for settable accelerometers and baroswitches. (auth)

9764 (SC-TM-343-63(14)) MASS SPECTROGRAPHIC ANALYSIS OF ERBIUM AND CERIUM METAL. J. W. Guthrie (Sandia Lab., Albuquerque, N. Mex.). Dec. 1963. Contract [AT(29-1)-789]. 8p.

Results are reported of analyses of 50 bulk impurity elements in 6 different erbium metal samples and 41 bulk impurity elements in 2 different cerium metal samples. A detection limit range of 0.1 to 20 ppm atomic was used. (auth)

9765 (SC-TM-356-63(91)) SOME GEOMETRIC PROPERTIES OF HYPERCUBES. G. J. Simmons (Sandia Corp., Albuquerque, N. Mex.). Dec. 1963. Contract AT(29-1)-789. 15p.

Four theorems pertaining to the geometry of an n-dimensional hypercube are given. In each case the problem which prompted the formulation of the theorem arose in the course of studies of an associative memory, and the results appear to be of interest for binary coding theory. The general applicability in coding theory of each theorem is indicated. (auth)

9766 (TID-4005(Pt.1, 7th Ed.)) SUMMARIES OF THE USAEC BASIC RESEARCH PROGRAMS IN METALLURGY, SOLID STATE PHYSICS AND CERAMICS. (Division of Research, AEC). 372p.

A detailed summary is presented of the program on materials science supported by the Office of Metallurgy and Materials Programs of the Division of Research of AEC. The summary includes the research programs active during the fiscal year 1963 and is divided into two parts according to research done in AEC laboratories and elsewhere. Author and subject indexes are included. (D.L.C.)

9767 (TID-19903) DIRECT CURRENT MEASUREMENTS AND HYDROGRAPHIC OBSERVATIONS IN THE CARIBBEAN-ANTILLEAN REGION. PART I. BACKGROUND AND PLAN OF RESEARCH. PART II. EXPERIMENTAL PROCEDURES AND FIELD WORK, R/V CONRAD CRUISE 7, LEG 3. Technical Report CU-5-63. Robert Gerard (Columbia Univ., Palisades, N. Y. Lamont Geological Observatory). Nov. 1963. Contract AT(30-1)-2663. 36p.

A program of direct current measurements carried out in certain regions of the Caribbean during August and September 1963 is described. The design, locations, and emplacement of the equipment are covered, as well as

the experimental procedures. Hydrographic and topographical observations were also taken. The data are being processed. (D.C.W.)

9768 (TID-19935) EFFECT OF PLANT CELL WALL COMPONENTS ON APPARENT BROWSE PLANT DIGESTIBILITY BY MULE DEER. Henry L. Short (Colorado Cooperative Wildlife Research Unit, Fort Collins). [1963]. Contract AT(11-1)-898. 12p.

Results are reported from nine feeding trials with seven browse diets with yearling mule deer (Odocoileus hemionus) during 1962. The experimental procedures are described. Dietary cellulose showed a statistically demonstrable relation to relative energy utilization of the test feeds. As the cellulose content of a feed increased, the digestible energy of the feed decreased. (C.H.)

9769 (TID-19936) EFFECT OF VARYING LEVELS OF CELLULOSE ON THE APPARENT DIGESTIBILITY OF FEEDS BY MULE DEER. Henry L. Short (Colorado Cooperative Wildlife Research Unit, Fort Collins). [1963]. Contract AT(11-1)-898. 11p.

Results are reported for nine feeding trials completed during 1963 to further illustrate the effects of dietary cellulose on feed digestibility by mule deer (Odocoileus hemionus). (C.H.)

9770 (TID-19938) RUMEN AND RETICULUM, AND SEASONAL VOLATILE FATTY ACID CHARACTERISTICS OF COLORADO MULE DEER. Henry L. Short, Dean E. Medin, and Allen E. Anderson (Colorado Cooperative Wildlife Research Unit, Fort Collins). [1962]. Contract AT(11-1)-898. 13p.

Thirty mule deer (Odocoileus hemionus) collected throughout 1962, from the Cache la Poudre range of Colorado, were studied. Several rumen + reticulum to body weight relations and the seasonal differences in the rumen contained volatile fatty acids (VFA) are described. Several differences (notably relative sizes of the rumen + reticulum, and pH, dry matter and VFA levels) are present between these data and published results for the cow. Rumen + reticulum VFA concentrations increased from 145 mM/L (where L = rumen + reticulum volume) with a pH of 5.7 in January and February to 240 mM/L with a pH of 5.3 from late May to July. This difference in seasonal VFA levels is also reflected in the molar percentages of the individual VFA's present. It is estimated that rumen + reticulum volatile fatty acids might account for up to 50% of the deer's basal metabolic energy during January and February, but 80% of the basal metabolic energy requirements during the summer. (auth)

9771 (TID-19939) THE USE OF FECAL CELLULOSE TO ESTIMATE PLANT TISSUE EATEN BY DEER. Henry L. Short and Elmer E. Remmenga (Colorado Cooperative Wildlife Research Unit, Fort Collins and Colorado State Univ., Fort Collins.). [1962]. Contract AT(11-1)-898. 10p.

Feeding trials conducted in 1962, with native browses, indicated relations between feed and fecal dry matter, lignin and cellulose. Prediction equations describing these relations are listed. Two range studies are described that indicated the feasibility of using fecal cellulose content to estimate plant tissue eaten by deer. (auth)

9772 (TID-19948) THE DIGESTION, ABSORPTION, TRANSPORT AND METABOLISM OF FATS IN THE RUMINANT. Progress Reports, September 1961–June 1963. (Gt. Brit. Agricultural Research Council. National Inst. for Research in Dairying, Reading, England). Contract 70/US. 14p.

Progress is reported in studies on the digestion, absorption, transport, and metabolism of lipids in dairy cows. Tritium-labeled triglycerides and tritiated olive oil given by mouth were used as tracers. Lipids and lipoprotein fractions were determined by chromatography after extraction and fractionation from samples of blood plasma, blood serum, whole blood, red blood cells, and milk. The specific activity of each fraction was determined. (C.H.)

9773 (TID-19979) ACTIVATION ENERGIES FOR DIFFUSION AND FOR THE ZENER RELAXATION IN DILUTE SOLID SOLUTIONS. D. P. Seraphim, A. S. Nowick, and B. S. Berry (International Business Machines Corp. Thomas J. Watson Research Center, Yorktown Heights, N. Y.). [1962]. Contract [AT(30-1)-2811]. 15p.

The problem of the discrepancy between the activation energies for tracer diffusion and the activation energy for the Zener relaxation in substitutional solid solutions is attacked by going to dilute alloys. Using single crystals of αAg–Zn alloys it has been possible to obtain, by extrapolation, a value, Q_r = 39.0 kcal/mole, for the activation energy for relaxation in alloys approaching infinite dilution. This value is distinctly below those for tracer diffusion of Zn and of Ag in pure silver. The interpretation of these three activation energies and the reasons why they differ are much more apparent for the dilute alloys than for the concentrated alloys previously studied. Specifically, Q_r is the activation energy involved in the reorientation of a Zn–Zn pair, while the tracer measurements relate to the jump of isolated Zn and Ag atoms, respectively. Measurements were also obtained for the orientation dependence of the relaxation time in single crystals of the 26 at. % Zn alloy. The results are very nearly independent of orientation. (auth)

9774 (TID-19988) CONTROL BY IRON OF THE GROWTH OF MARINE ALGAE. C. A. Price (Woods Hole Oceanographic Institution, Mass.). 1963. Contract AT(30-1)-1918. 21p.

A research program was initiated to study the differences in iron metabolism that permit oceanic species, but not coastal species, of algae to fluorish at iron concentrations less than 10μg/l. Data on the accumulation of Fe^{59} by Skeletonema costatum are reported. The concentration of N,N-di(hydroxyethyl)glycine required to stabilize iron in ocean water was calculated. The growth of Skeletonema with and without iron and of Coccolithus without iron was studied. Exchange of millipore-filterable Fe^{59} with Skeletonema is reported. (D.L.C.)

9775 (TID-19992) DISPLACEMENT AND EXCHANGE REACTIONS INVOLVING ORGANOMETALLIC COMPOUNDS. Annual Progress Report. Henry G. Kuivila (New Hampshire. Univ., Durham). Jan. 1, 1964. 68p. Contract AT(30-1)-2970.

Work on the preparation of 5-trimethylsilylnorbornenes and the configurations has been completed and is reported. Results of the study of 5-norbornenyltrimethyltin are summarized. The mechanism of the cleavage of allyltins by HCl is shown to be probably SE2'. The effects of metal ion catalysis on the protodeboronation of benzeneboronic acids were studied. The synthesis of several unsaturated organometallics is reported. (D.L.C.)

9776 (TID-20003) PHOSPHORUS METABOLISM IN LAMBS FED VARYING PHOSPHORUS INTAKES. PART I. Final Technical Report. R. L. Preston (Missouri. Univ., Columbia). Jan. 1964. Contract AT(11-1)-1011. 39p.

Results are summarized from a growth and metabolism trial using 24 lambs fed 0.12, 0.15, or 0.29% P in a com-

plete ration. Data are presented on P deficiency, body weight gain, and feed intake. A formula is presented for use in calculating P requirements for growing lambs. (C.H.)

9777 (TID-20010) PRECIPITATION OF ZINC 8-HYDROXYQUINALDATE FROM HOMOGENEOUS SOLUTION. S. Hikime and L. Gordon (Case Inst. of Tech., Cleveland). [1963]. Contract AT(11-1)-582. 33p.

Zinc 8-hydroxyquinaldate can be precipitated quantitatively from homogeneous solution with 8-hydroxyquinaldine generated by the hydrolysis of 8-acetoxyquinaldine. Separation studies indicate the superiority of this method over the conventional procedure using 8-hydroxyquinoline. (auth)

9778 (TID-20012) SOME REFLECTIONS ON THE CHELATE EFFECT. Arthur E. Martell (Illinois Inst. of Tech., Chicago). [nd]. Contract AT(11-1)-1020. 20p.

The "chelate effect," proposed by Schwarzenbach to explain the unusual stability of metal chelates, involves primarily an entropy contribution to the stability. The process of metal chelate formation in solution is analyzed and the factors involved in the entropy and enthalpy contributions are outlined. These factors are inspected with respect to differences between metal chelate formation and complex formation, and it is concluded that the "chelate effect" is still valid. (D.L.C.)

9779 (TID-20016) POLAROGRAPHIC DETERMINATION OF PARABANIC ACID. Report No. 80. William A. Struck and Philip J. Elving (Michigan. Univ., Ann Arbor. Dept. of Chemistry). Dec. 12, 1963. Contract AT(11-1)-1148. 7p.

Parabanic acid gives a well-defined polarographic wave in aqueous acetate and mixed acetate-phosphate media of about pH 4 to 6, which wave is well suited for the quantitative determination of parabanic acid in complex samples. The wave height is proportional to concentration with the diffusion current constant being 3.6. The relatively low half-wave potential for an organic compound of ca., –0.8 volt at the pH indicated is conducive to selectivity. The wave is apparently due to a two-electron reduction of the parabanic acid. (auth)

9780 (TID-20017) MASS SPECTROMETRIC STUDY OF THE REACTION OF WATER VAPOR WITH SOLID BARIUM OXIDE. F. E. Stafford (Northwestern Univ., Evanston, Ill.) and J. Berkowitz (Argonne National Lab., Ill.). [1963]. Contract [AT(11-1)-1126]. 23p.

Barium oxide disks in a platinum Knudsen cell were reacted with water vapor at temperatures between 1485 and 1785°K and water pressures up to approximately 10^{-4} atm. The effusing molecules were identified and measured mass spectrometrically. Although no $Ba(OH)_2^+$ ion was observed, the species $BaOH^+$ was inferred to have come from both BaOH and $Ba(OH)_2$ because of its dependence on the water pressure. From the observed equilibria $BaO(s) + H_2O(g) \rightarrow Ba(OH)_2(g)$, $\Delta H = 50.0$ kcal/mole; $BaO(s) + BaO(g) + H_2O(g) \rightarrow 2BaOH(g) + \frac{1}{2}O_2(g)$, $\Delta H = 122.3$ kcal/mole; $2BaO(g) + H_2O(g) \rightarrow 2BaOH(g) + O(g)$ $\Delta H = 69.2$ kcal/mole. These lead to a HOBa = OH bond energy of 99 kcal/mole and a Ba = OH bond energy of 107 kcal/mole. The latter number differs significantly from a value deduced from studies of flame spectra and implies that the concentration of hydroxide species in these flames has been underestimated by several orders of magnitude. (auth)

9781 (TID-20021) METASTABLE SOLID SOLUTIONS IN ALUMINUM–MAGNESIUM ALLOYS. Technical Report No. 21. H. L. Luo, C. C. Chao, and P. Duwez (California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials). Dec. 1963. Contract AT(04-3)-221. 14p.

By rapidly quenching Al–Mg alloys from the melt, the limits of terminal solid solubility can be extended from 18.9 to about 39 at. % of Mg in Al, and from 11.6 to about 26 at. % of Al in Mg. Quenched alloys of compositions within the β and γ fields have the equilibrium crystal structures of these two phases. A discussion is given of the variation of atomic volume with composition. (auth)

9782 (TID-20027) [PHOSPHATE METABOLISM OF ESCHERICHIA COLI]. Progress Report. (International Atomic Energy Agency, Vienna). [nd]. Contract [AT (30-1)-2616]. 5p.

Progress is reported on studies of phosphate metabolism in Escherichia coli. Data on intermediate metabolism were processed in an analog computer to obtain information on rates of reaction. Results are reported from studies using C^{14}-glucose as a tracer. (C.H.)

9783 (TID-20028) THE DIGESTION, ABSORPTION, TRANSPORT AND METABOLISM OF FATS IN THE RUMINANT. Progress Report, January–June 1963. (International Atomic Energy Agency, Vienna). Work Performed under Contract IAEA/US. 4p.

Progress is reported in studies of lipid metabolism and the lipid content of plasma and milk in dairy cows and sheep in which tritium-labeled triglycerides were used as tracers. Methods were developed for the separation of lipoproteins from blood and the scintillation counting of samples of whole milk and blood serum. (C.H.)

9784 (UCRL-11069) KINETICS OF AROMATIC NITRATION. Reid Clark Miller and Theodore Vermeulen (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley). Oct. 15, 1963. Contract W-7405-eng-48. 57p.

Heterogeneous nitration rates of the aromatic organic compound 1,3-bis(trifluoromethyl)benzene in a well-agitated batch system have been measured in an extensive range of very concentrated mixed acids (aqueous HNO_3 and H_2SO_4), with each run at essentially constant acid composition. The observed conversions correlated well with a first-order dependence on the fraction of aromatic unconverted. Solubilities of the aromatic compound have been measured over the range of acid compositions. By eliminating solubility from the kinetic results, the apparent rate coefficient along the H_2SO_4–H_2O base line is found to have a maximum value near 92 weight-percent H_2SO_4. The coefficient also exhibits a maximum on the HNO_3–H_2SO_4 base line at approximately 55 weight-percent H_2SO_4. The nitration rates are correlated in a manner that indicates, at any given mixed-acid composition, (a) the nonideality of the reaction medium expressed by the activity-coefficient behavior; and (b) the ability of the medium to convert HNO_3 to NO_2^+, the attacking species in the nitration sequence. To apply this correlation to aromatics having varying resistance to nitration, the correlation has been extended to the dilute mixed-acid region, using equilibrium equations based on the nitronium-ion mechanism. This correlation is generally applicable, except for effects that are not a direct result of the state of the acid medium—such as a change in aromatic solubility, a change in aromatic reactivity through complexing or protonation, or a change in the nitration mechanism characteristic of the particular aromatic. From the nitration kinetics, values of the Hammett acidity function at 25°C are estimated for mixed-acid

compositions, as interpolations between previously determined experimental values along the HNO_3-H_2O and $H_2SO_4-H_2O$ base lines. (auth)

9785 (USNRDL-TR-688) ACID DEOXYRIBONUCLEASE (DNase II) IN RAT LIVER CELL NUCLEI ISOLATED IN THE PRESENCE OF Ca^{++}. K. F. Swingle and L. J. Cole (Naval Radiological Defense Lab., San Francisco). Nov. 1, 1963. 30p. (AD-426890)

Nuclear fractions centrifugally separated from rat liver homogenates in isotonic sucrose or in water, containing in each case 1.8×10^{-3} M $CaCl_2$, and washed repeatedly in the same media, retained a considerable amount of acid DNase activity. Similarly prepared nuclear fractions using calcium-free media lost nearly all of their DNase activity. This retention of activity in the presence of calcium was shown to be neither co-sedimentation of unbroken cells or of lysosomes with the nuclear fraction nor precipitation of soluble DNase in the presence of calcium. The nuclear-bound enzyme was active under conditions which were shown not to remove it from the nuclei. (auth)

9786 (AEC-tr-6259) THERMAL DECOMPOSITION MECHANISM OF CALCIUM, STRONTIUM, AND BARIUM SULFITES. A. N. Ketov and V. V. Pechkovskii. Translated for Oak Ridge National Lab., Tenn., from Nauch. Dokl. Vysshei Shkoly, Khim. i Khim. Tekhnol., No. 4, 667-71(1958). 6p.

The thermal decomposition of $CaSO_3$, $SrSO_3$, and $BaSO_3$ at 600 to 800°C was studied as a function of temperature, duration, and gas atmosphere (N_2 or SO_2). The results indicate that the reactions are $MeSO_3 \rightarrow MeO + SO_2$, $2MeSO_3 + SO_2 \rightarrow 2MeSO_4 + \frac{1}{2} S_2$, $2\,MeO + 1\frac{1}{2} S_2 \rightarrow 2\,MeS + SO_2$, and $MeSO_3 + \frac{1}{2} S_2 \rightarrow MeS_2O_3$. The rate of transformation of the sulfite into sulfate increases from Ca to Ba, and the density of the sulfate is shown to have an effect on the total rate of thermal decomposition. (D.L.C.)

9787 (AEC-tr-6261) EXPERIMENTS FOR THE STUDY OF THE AUXIN TRANSPORT IN THE COLEOPTILE OF ZEA MAYS L. R. Hertel and A. C. Leopold. Translated by Elmar K. Wilip (Argonne National Lab., Ill.), from Planta: 59: 535-62(1963). 31p.

Auxin transport through tissue sections of Zea mays was studied using C^{14}-labeled indoleacetic acid as a tracer. A model is presented by which auxin movement is described as a secretion from cell to cell. (C.H.)

9788 (AEC-tr-6262) ON N-GLYCOSIDES, REPORT NO. III. STERIC COURSE OF HYDROGENATION OF ISOGLYCOSAMINES; ROTATIONAL LAWS FOR 9-POLYOXYALKYLFLAVINES AND N-POLYOXYALKYLAMINOBENZENES. Friedrich Weygand. Translated for Oak Ridge National Lab., Tenn., from Chem. Ber., 73: 1278-83 (1940). 11p.

The steric effects of hydrogenation of the isoglycosamines are reviewed. The reduction product of 3,4-dimethylphenyl-1-isoarabinosamine was found to be one or the other of the two possible epimers, 3,4-dimethylphenyl-1-arabinamine or 3,4-dimethylphenyl-1-ribamine, according to whether hydrogenation was carried out in an acid or alkaline alcoholic solution. The steric effect in the hydrogenation of ethylene derivatives is considered briefly. The rotational rule was used to determine from which of the pentoses the polyoxy chain in lactoflavin is derived. The same rule was applied to N-polyoxyalkylaminobenzenes. (D.L.C.)

9789 (AEC-tr-6263) POLAROGRAPHIC INVESTIGATIONS WITH CONTROL OF THE DROP TIME BY FORCED DROPPING. I. THE DROP-TIME DEPENDENCY OF POLAROGRAPHIC CURRENTS. D. Wolf. Translated for Oak Ridge National Lab., Tenn., from J. Electroanal. Chem., 5: 186-94(1963). 16p.

The rapping device manufactured by the Metrohm AG for the premature dropping of the mercury drop from the capillary results in dropping times between 0.18 to 1.03 sec. A variation of the dropping time results in the relation to the dropping time required by theory for the diffusion limiting current as well as for reaction-conditioned currents. Disturbances caused by rapid dropping (back-pressure effect) must be taken into consideration for measurements claiming a high accuracy. With the use of this equipment, the kinetic data of the breakthrough reaction $Ti^{4+} + e^- \rightarrow Ti^{3+}$ and the rate constants of pyroracemic acid were determined. The results are in good agreement with literature data. (auth)

9790 (AEC-tr-6281) VELOCITY, INTENSITY AND CAPACITY OF AUXIN TRANSPORT IN GEOTROPICALLY STIMULATED PEDICLE STUMPS OF FRITILLARIA MELEAGRIS L. Harald Kaldewey. Translated by Lydia Venters (Argonne National Lab., Ill.), from Planta, 60: 178-204(1963). 27p.

Auxin-free pedicle stumps of Fritillaria meleagris L. kept horizontally for at least 12 hr were apically supplied with a 10^{-3} IAA auxin paste. After 1 to 4 hour experiments at different temperatures, diffusible auxin could be detected nearer to the basis in the physical upper side than in the lower side. The average velocity of auxin transport in the upper side amounted to 3.5, 4.0, and 6.5 mm/h at air temperatures of ca 12, 15, and 30°C resp. The same values were obtained in the vertical controls. The corresponding values for the physical lower side amounted to 2.5, 2.5, and 4.5 mm/h and were significantly lower than in the upper side or in the vertical controls. The quotient velocity in the upper side/velocity in the lower side was 1.56 under the 3 experimental conditions tested. A difference between auxin movement in the upper and in the lower side was not clearly detectable, when pedicle stumps were placed horizontally and supplied with IAA-paste simultaneously. A tendency to decreasing transport velocity in the lower side could be shown indirectly. Auxin applied to mature pedicle stumps kept for 12 h horizontally moved equally into the upper and the lower side. The transport velocity resembled the velocity in the lower side of younger organs. The amount of diffusible auxin in sections of equal length from plants apically supplied with IAA-paste is called transport capacity. The transport capacities in corresponding upper and lower halves were equal. In order to compare the transport intensities in the upper and the lower side, pedicle stumps kept horizontally for at least 12 h were bisected longitudinally, divided in 5 mm-sections, and put upon an auxin paste film with their apical cut surface, thus maintaining the original geotropic stimulus position. Upper halves transported more IAA than lower halves during equal times. Auxin penetrated the tissue and was transported basipetally from 10^{-3} IAA-paste, applied in points to the epidermis of the physical upper side of pedicle stumps fixed in a horizontal position. Lateral movement could not be detected even after more than 12 hours. Problems of geotropism are discussed under the aspect of a geotropically induced asymmetry of auxin transport velocity. (auth)

9791 (AI-Trans-28) ION CONDUCTIVITY PRESSURE DEPENDENCE OF ANOMALOUS AgBr AND AgI MIXED CRYSTALS. K. Wagener. Translated by Anthony Cornell (Atomics International, Div. of North American

Aviation, Inc., Canoga Park, Calif.), from Z. Physik. Chem. (Frankfurt), 23: 305-12(1960). 9p.

Measurements of the pressure coefficient of the ion conductivity of AgBr, AgI, and anomalous mixed crystals of $AgBr-CdBr_2$ and $AgI-PbI_2$ at different temperatures are reported. The pressure coefficients of AgBr and AgI are opposite in sign. The compression and expansion values of the pressure coefficient of $AgI-PbI_2$ differ from each other, especially at compositions above 1.3 mole % PbI_2. (D.L.C.)

9792 (AI-Trans-29) CRITICAL TEMPERATURE DETERMINATION OF SOME MERCURIC HALIDES. L. Rotinjanz and W. Suchodski. Translated by Anthony Cornell (Atomics International, Div. of North American Aviation, Inc., Canoga Park, Calif.), from Z. Physik, 87: 253-6(1914). 5p.

The critical temperature was determined to be 976 ± 1°K for $HgCl_2$, 1011 ± 1°K for $HgBr_2$, and 1072 ± 3°K for HgI_2. The ratio of the boiling point to the critical temperature is 0.592, 0.487, and 0.584, respectively. The use of Thorpe and Rucker's equation for calculating the critical temperature yields results which are in agreement with experimental values for $HgBr_2$ and HgI_2 but not $HgCl_2$. (D.L.C.)

9793 (AI-Trans-30) "FISH-SCALES"—A DEFECT OF SHEET-STEEL ENAMELING. Rudolf Maerker. Translated by Anthony Cornell (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.), from Sprechsaal, 95: 316-26(1962). 34p.

A review is presented of the practical knowledge and experience gathered on the appearance of "fish scales" (cracks) in the enameling of sheet steel. The gas escaping from the fish scales was found to be mostly H_2, and the possible sources of H_2 are examined in detail. It is concluded that water escapes when wet milled enamel is fired, that water vapor formation continues even when the enamel is softened, and that H_2 forms by the reaction of the water vapor with the red-hot sheet steel. (D.L.C.)

9794 (AI-Trans-64-3) CONTRIBUTION TO THE STUDY OF THE STRUCTURE OF DILUTE SOLUTIONS OF COBALT IN COPPER. R. Tournier, J. J. Veyssie, and L. Weil. Translated by Anthony Cornell (Atomics International., Div. of North American Aviation, Inc., Canoga Park, Calif.), from J. Phys. Radium, 23: 672-6[1962]. 11p.

The magnetic properties and specific heat of a series of dilute alloys of Co in Cu (concentration less than 3 at. %) were studied at temperatures less than 4°K and down to about 0.01°K for the magnetic properties. The use of strong quenchings allowed an important part of the cobalt to remain "in solution." The magnetic properties suggest the general aspect of the precipitates which appear under these conditions. The specific heat values give no further information. (auth)

9795 (SC-T-64-40) ESTIMATION OF SOME PHYSICAL AND PHYSICOCHEMICAL PROPERTIES OF CHEMICAL COMPOUNDS. Egon Bauman. Translated for Sandia Corp., Albuquerque, N. Mex., from Nafta (Zagreb), 7: 335-44(Nov. 1956). 25p.

The problems involved in obtaining the properties of substances for chemical engineering studies of prospective processes are described briefly. Methods are given for predicting the properties of organic compounds. In some cases, methods are compared, and some methods are given for inorganic compounds. These properties include critical properties, molecular volume and density, vapor pressure, heats of vaporization and fusion, specific heat, viscosity, heat conductivity, and heat of combustion. As an example of the applications of the methods, the properties of acetone are calculated and compared with experimental values. (D.L.C.)

9796 (SC-T-64-41) THERMAL TELOMERIZATION OF OLEFINS WITH SILICON HYDRIDES. R. Kh. Freidlina, A. N. Nesmeyanov, E. Ts. Chukovskaya, and Sh. A. Karapetyan. Translated by Marcel I. Weinreich (Sandia Corp., Albuquerque, N. Mex.), from Khim. i Prakt. Primenenie Kremneorgan. Soedin., Tr. Konf., Leningrad, 1958, No. 6, 72-82(1961). 14p.

A treatment is presented of the mechanism of the thermal telomerization reactions of ethylene and substituted ethylenes with substituted silicon hydrides and of the possibility of using catalysts in these reactions. It is shown that the reactions can take place in the absence of any initiators or catalysts and that the reactions are initiated by the dissociation of Si–H bonds. The effects of reaction variables are discussed. Several catalysts were investigated using ethylene and propylene; H_2PtCl_6 and $ZrCl_4$ were found to cause only simple addition reactions with methyldichlorosilane, while $H_2SnCl_6 \cdot 6\,H_2O$ and $TiCl_4$ caused true telomerization reactions. (D.L.C.)

9797 AVAILABILITY AND USE OF RADIOACTIVITY STANDARDS. W. S. Lyon (Oak Ridge National Lab., Tenn.). Anal. Chem., 36: 31A-3; 35A; 37A-9(Feb. 1964).

A review on the availability and use of radioactivity standards includes discussions on the usefulness and accuracy of nuclear data as presently compiled and the distribution of standards. It was concluded that a need for better nuclear data exists. Information and instruction are needed to aid the non-specialist in deciding when absolute standards are really needed and how to use them. Standards producers should supply more information concerning the method of assay, errors, and chemical form of the standard. (P.C.H.)

9798 THE PEACEFUL USES OF NUCLEAR ENERGY IN THE GERMAN FEDERAL REPUBLIC. K. Kaissling (Bundesministerium f. Wissenschaftliche Forschung, Bad Godesberg, Ger.). Ber. Deut. Keram. Ges., 40: 67-72 (Feb. 1963). (In German)

In the German Federal Republic research on peaceful applications of nuclear energy began in 1955. There are 7 research centers: Karlsruhe, Jülich, Munich-Garching (Institute of Plasma Physics), Hamburg-Geesthacht, Hamburg (German electron synchrotron), Berlin (Hahn/Meitner Institute), and Munich-Neuherberg (radiation protection). For an assessment of German conditions the following factors were considered: late starting, absence of military atomic program, adequate supply of organic fuels, federal structure of the state, and economic system. Technical and economic aspects were considered. The influence of nuclear technology on the fuel and power and the building industries is discussed. (auth)

9799 HOW TO KEEP INFORMED TODAY. Walter L. Fleischmann (Knolls Atomic Power Lab., Schenectady, N. Y.). Metal Progr., 122-3; 46(Nov. 1963). (KAPL-P-2276; TID-18614)

A review on science information centers and their publications for the dissemination of scientific and technological information is presented. Government sources of information are listed. (P.C.H.)

9800 PROCEEDINGS OF THE AMERICAN POWER CONFERENCE, MARCH 26, 27, AND 28, 1963, CHICAGO,

ILLINOIS. Proc. Am. Power Conf., 25: 1-962(1963). Chicago, Illinois Institute of Technology, 1963. $10.00.

A total of 111 papers are presented on topics related to the generation, transmission, distribution, and utilization of power. The papers are divided into sessions dealing with general interest, atomic energy, mechanics, industry, and water technology. Separate abstracts were prepared for 6 of the papers which deals with nuclear power, magnetohydrodynamic plants, and space power plants, while 11 other papers were previously abstracted in NSA. (D.L.C.)

For abstracts of individual papers see: 8941, 9078, 9627, 9668, 9669, and 9670.

9801 TECHNOLOGY, ENGINEERING AND SAFETY. VOLUME 5. C. M. Nicholls, ed. Progress in Nuclear Energy. Series IV. Progr. Nucl. Energy, Ser. IV, 5: 1-622(1963). New York, Pergamon Press, 1963. 632p. $17.50.

Reviews of selected topics on the technology of reactors, materials, processes, and general subjects, engineering, and nuclear safety are presented. One of the 18 papers was previously abstracted in NSA; the remaining 17 are abstracted separately. (R.E.U.)

For abstracts of individual papers see: 8374, 8451, 8564, 8565, 8669, 8702, 8737, 8738, 8760, 8761, 8893, 9061, 9569, 9570, 9571, 9628, and 9671.

9802 A GRADUATE RESEARCH PROGRAM IN NUCLEAR ENGINEERING AND SCIENCES. M. L. Yeater (Rensselaer Polytechnic Inst., Troy, N. Y.). Trans. N. Y. Acad. Sci., 25: 522-43(Mar. 1963).

Research problems in reactor physics, nuclear spectroscopy, and radiation effects on materials are discussed. The R.P.I. linac and associated facilities are described. The time dependence of flux on space, energy, and angle transients is being studied. Precision measurements of asymptotic and time-dependent spectra in moderators and subcritical assemblies are reported. Measurements of neutron capture and fission cross sections and the detailed study of certain photonuclear disintegrations are reported as in progress. Some results are given for isotopic assignments of hafnium energy levels. Other programs reported are molecular energy levels and neutron cross sections from low-energy neutron inelastic scattering, plans for mass spectrometric isotopes laboratories, and radiation damage in semiconductors and thin metal films. (R.E.U.)

CORPORATE AUTHOR INDEX

This index contains entries for this period for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt.," permitting a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

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ACADEMIA R. P. R. INSTITUTUL DE FIZICĂ ATOMICĂ, BUCHAREST.
Multiple meson production in π-p interactions, 18: 9085 (NP-13532)

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CHICAGO. UNIV. ENRICO FERMI INST. FOR NUCLEAR STUDIES.
Self-consistent breakdown of symmetries, 18: 9097 (UR-875-11(p.183-99))
CHICAGO. UNIV. INST. FOR COMPUTER RESEARCH.
Prog. rpt. on computer research, annual, 1963, 18: 8709 (TID-19993)
CHICAGO. UNIV. INST. FOR THE STUDY OF METALS.
Electron theory of metals and alloys, 18: 8789 (CONF-356-7)
Hall effect in liquid metals, 18: 9000 (TID-19959)
COLORADO COOPERATIVE WILDLIFE RESEARCH UNIT, FORT COLLINS.
Effect of cell wall on browse plant digestibility by deer, 18: 9768 (TID-19935)
Effect of cellulose on digestibility of feeds by deer, 18: 9769 (TID-19936)
Rumen and reticulum, and seasonal volatile fatty acid characteristics of mule deer, 18: 9770 (TID-19938)
Use of fecal cellulose to estimate plant tissue eaten by deer, 18: 9771 (TID-19939)
COLORADO STATE UNIV., FORT COLLINS.
Use of fecal cellulose to estimate plant tissue eaten by deer, 18: 9771 (TID-19939)
COLORADO. UNIV., BOULDER.
Prog. rpt. on congenital deformity in mice induced by radiation, 12/63, 18: 8117 (TID-20029)
COLUMBIA UNIV., NEW YORK.
Biophysics, 18: 8105 (NYO-2740-1(p.91-154))
Dosimetry, 18: 8104 (NYO-2740-1(p.7-30))
Effects of x irradiation on central nervous system, 18: 8102 (BNL-7620)
Microscopic distribution of radiation energy, 18: 8548 (NYO-2740-1 (p.31-53))
Other physics, 18: 8647 (NYO-2740-1(p.75-90))
Prog. rpt. on research projects, annual, 1963, 18: 8047 (NYO-2740-1)
Radiation protection, 18: 8646 (NYO-2740-1(p.54-74))
Radiobiology, 18: 8106 (NYO-2740-1(p.155-98))
COLUMBIA UNIV., PALISADES, N. Y. LAMONT GEOLOGICAL OBSERVATORY.
Current and hydrographic observations in Caribbean-Antillean region, 18: 9767 (TID-19903)
COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
Prog. rpt. on burnable poison additions to UO_2, 7/62–6/63, 18: 8765 (CEND-181)
Prog. rpt. on stress corrosion cracking of stainless steels, 9/63, 18: 8748 (CEND-198)
Prog. rpt. on testing UO_2 fuel systems, 6/15/62–7/31/63, 18: 8715 (CEND-186)

D

DARTMOUTH COLL., HANOVER, N. H.
Prog. rpt. on annular two-phase flow, 7–9/63, 18: 8485 (NYO-10488)
DEFENSE DOCUMENTATION CENTER, ARLINGTON, VA.
Bibliography on plasma physics and magnetohydrodynamics, 18: 9449 (AD-405732)
Bibliography on radiation sterilization of foods, 1957-62, 18: 8045 (AD-404119)
DENMARK. ATOMENERGIKOMMISSIONEN. FORSØGSINSTITUT, RISØ.
Analysis of failure data for electronic equipment, 18: 8615 (RISÖ-38)
Measurement of γ flux in thermal column, 18: 8648 (RISÖ-67)
DENVER. UNIV. DENVER RESEARCH INST.
Prog. rpt. on oxidation resistance of $NbAl_3$, final, 9/62–8/63, 18: 8749 (DRI-2134)
Prog. rpt. on phase diagrams Nb–W–Hf and Nb–W–Zr, 12/63, 18: 8792 (DRI-2131)
DIVISION OF BIOLOGY AND MEDICINE, AEC.
Fallout prediction techniques, 18: 8517 (SC-DC-3553(p.219-29))
Marine sciences related to aerospace uses of nuclear power, 18: 8062 (SC-DC-3553(p.195-207))
DIVISION OF REACTOR DEVELOPMENT, AEC.
Reactors in U. S., 12/63, 18: 9566 (TID-8200(9th Rev.))
DIVISION OF RESEARCH, AEC.
USAEC basic research programs in metallurgy, solid-state physics, and ceramics, 18: 9766 (TID-4005(Pt-1, 7th Ed.))
DIVISION OF TECHNICAL INFORMATION, AEC.
Measurement methods for Pu and U, 18: 8283 (TID-7029)
DIVISION OF TECHNICAL INFORMATION EXTENSION, AEC.
Bibliography on reactor containment, 18: 9579 (NP-12980)
Engineering materials list drawing number index, 18: 8463 (TID-4101)
DOUGLAS AIRCRAFT CO., INC., SANTA MONICA, CALIF.
Research in advanced propulsion systems, 18: 9714 (NP-13468)
DOW CHEMICAL CO. ROCKY FLATS DIV., GOLDEN, COLO.
Plutonium nitrate solution instability, 18: 8331 (RFP-357)
DU PONT DE NEMOURS (E. I.) & CO. ATOMIC ENERGY DIV., WILMINGTON, DEL.
Thorium-fueled D_2O-moderated power reactors, 18: 9643 (DP-864)
DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
Performance of multi-stage centrifugal contactor, 18: 8443 (DP-841)
Prog. rpt. on effect of rod spacing on heat transfer burnout, 10/63, 18: 9613 (DPST-63-69-11)
Prog. rpt. on effect of rod spacing on heat transfer burnout, 11/63, 18: 9614 (DPST-63-69-12)
Prog. rpt. on thin-walled Zy tubing, 10/63, 18: 8791 (DPST-63-74-10)
DUBLIN INST. FOR ADVANCED STUDIES.
Broken symmetries in terms of inequivalent representations, 18: 9102 (UR-875-11(p.390-410))
DUQUESNE LIGHT CO., SHIPPINGPORT, PENNA.
Prog. rpt. on Shippingport operation, 11/63, 18: 9642 (DLCS-5001163)

E

EDGERTON, GERMESHAUSEN AND GRIER, INC., LAS VEGAS, NEV.
Measurements in structures from fallout, 18: 8509 (CEX-59.7b (Part II))
EDGERTON, GERMESHAUSEN AND GRIER, INC., SANTA BARBARA, CALIF.
Measurements in structures from fallout, 18: 8509 (CEX-59.7b (Part II))
EINDHOVEN, NETHERLANDS. TECHNISCHE HOGESCHOOL.
Heat transfer and stability studies in BWR, 18: 8475 (EURAEC-661)
Hydrodynamic aspects of two-phase flows in vertical boilers. I and II., 18: 8479 (EURAEC-885)
Steady-state boiling in annular geometry, 18: 8477 (EURAEC-856)
ELTEX RESEARCH CORP., LINCOLN, R. I.
Prog. rpt. on chelating agents for enhancing urinary excretion of Sr, 1–11/63, 18: 8393 (TID-19989)
EUROPEAN ATOMIC ENERGY COMMUNITY.
Conference on medical supervision of workers exposed to ionizing radiations, Ispra, 5/61, 18: 8568
Determination of trace impurities in organic materials, 18: 8268 (EUR-432.f)
EUROPEAN ATOMIC ENERGY COMMUNITY. JOINT NUCLEAR RE-

SEARCH CENTER, ISPRA, ITALY.
Determination of trace impurities in organic materials, 18: 8268 (EUR-432.f)

F

FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE, PARIS.
Fabrication of U–Pu elements, 18: 8782 (EURAEC-891)
Irradiation of steel specimens and post-irradiation tests, 18: 8877 (EURAEC-816)
Prog. rpt. on behavior of sintered UO_2 under irradiation, 4–6/63, 18: 8733 (EURAEC-734)
Prog. rpt. on Pu recycling, 10–12/62, 18: 8732 (EURAEC-566)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, CADARACHE.
Fabrication of U–Pu elements, 18: 8782 (EURAEC-891)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, FONTENAY-AUX-ROSES.
Intense plane-beam ion source, 18: 9450 (CEA-2364)
Oscillation of U slugs in "Marius", 18: 9733 (EURAEC-781)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Determination of O dissolved in water, 18: 8266 (CEA-Bib-36)
Determination of gases in metals, 18: 8289 (AEC-tr-6266)
Neutron penetrabilities using optical model potential, 18: 9307 (CEA-2380)
FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE DE PRODUCTION DE PLUTONIUM DE MARCOULE, CHUSCLAN.
Decontamination using electrolytic method on stainless steel, 18: 9741 (CEA-2353)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Externally driven circulators with turbocirculator, 18: 9576 (GAMD-4691)
GATHER-II—IBM-7090 program for computation of thermal-neutron spectra, 18: 9291 (GA-4132)
Influence of coated particles on graphite-matrix fuel compacts, 18: 8794 (GAMD-4441)
Invariance of magnetic moment for short wavelength perturbations, 18: 9453 (GA-4843)
Prog. rpt. on thermionic converters, 3/62–9/63, 18: 9064 (GA-4012)
GENERAL ELECTRIC CO. ATOMIC POWER EQUIPMENT DEPT., SAN JOSE, CALIF.
Influence of Doppler effect on meltdown accident, 18: 9602 (GEAP-4420)
Prediction of two-phase critical flow rate, 18: 8480 (GEAP-4395)
Preliminary results of VBWR noise analysis, 18: 9639 (CONF-332-8)
Prog. rpt. on transition boiling heat transfer, 10–12/63, 18: 8481 (GEAP-4487)
Reactor safety and fuel cycle economics, 18: 9644 (GEAP-4414)
GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Analytical studies and advanced concepts, 18: 9615 (HW-78388(p.3.1-15))
Application of multidimensional γ spectrometry, 18: 8642 (HW-SA-3225)
Automatic processing mechanical properties data, 18: 8502 (HW-SA-3108)
Average Cs-137 body burden in population by urinalysis, 18: 8078 (HW-SA-3222)
Bridge for NPR horizontal rod counting, 18: 9645 (HW-61240)
Chemical research and development, 18: 8445 (HW-78388(p.4.1-15))
Comparison of arsenious oxide and for standardization of ceric sulfate, 18: 8270 (HW-74555)
Comparison of LiOH and NH_4OH for N-reactor primary system coolant pH control, 18: 9708 (HW-79316)
Control rod calculations for Pu-fueled thermal reactor, 18: 9577 (HW-78332)
Costs of fabricating UO_2–PuO_2 fuel elements, 18: 8766 (HW-SA-3132)
Design and operation of PRTR gas-cooled loop facility, 18: 9647 (HW-SA-3294)
Determination of U in welds on Zr-clad fuel elements, 18: 8722 (HW-78549)
Fabrication of cermets by high-energy-rate impaction, 18: 8768 (HW-SA-3264)
Fixation of radioactive fission products, 18: 9742 (HW-SA-3233)
Fixed-time estimation of counting rates, 18: 8641 (HW-76279)
Forecasting dispersion from source near ground level, 18: 8907 (HW-SA-3192)
Fuels studies, 18: 8721 (HW-78388(p.5.1-22))
Gas-bearing compressors of PRTR gas-cooled loop facility, 18: 9728 (HW-SA-3232)
Gas-cooled reactor studies, 18: 8865 (HW-78388(p.6.1-9))
Geophysical seismic evaluation at Hanford Works, 18: 9751 (HW-SA-3280)
High-temperature UC–metal reactions, 18: 8795 (HW-72031)
In-reactor monitoring of Zy-2 PRTR pressure tubes, 18: 9727 (HW-SA-3008)
Influences of irradiation on fuel cladding, 18: 8868 (HW-SA-3268)
Instrumentation and nondestructive testing, 18: 8606 (HW-78388 (p.7.1-10))
Irradiation effects on materials, 18: 8866 (HW-78388(p.8.1-7))
Irradiation testing of Al–Pu–Ni alloy fuel rods, 18: 8867 (HW-SA-2909)
Light water injection into PRTR primary coolant system, 18: 9726 (HW-69724)
Materials development, corrosion, and heat transfer studies, 18: 8752 (HW-78388(p.9.1-4))
N-reactor process tube rolled joint step removal, 18: 9707 (HW-79022)
Physics, 18: 8912 (HW-78388(p.10.1-25))
Plutonium abstracts, Vol. 3, No. 12, 18: 9750 (HW-68600-34)
Plutonium recycle test reactor operation, 18: 9646 (HW-78388(p.11.1-15))
Prog. rpt. on reactor development, 4–6/63, 18: 9562 (HW-78388)
Radiation effects on UO_2 melting, 18: 8864 (HW-69234)
Radiation emergencies, 18: 8546 (HW-SA-3285)
Radioisotopic heat sources supplementary data, 18: 8699 (HW-78180)
Radiological conditions in vicinity of Hanford, 4–6/63, 18: 8545 (HW-78395)
Redox dissolver off-gas monitor, 18: 8269 (HW-63985)
Resistance bonding of graphite and refractory metals, 18: 8767 (HW-SA-3258)
Self-limiting reactor transient, 18: 9603 (HW-77147)
Thorium alloy core thermocouple element for fuel fouling detector, 18: 9709 (HW-79356)
Ultrasonic monitoring of NPR vibration fatigue specimens, 18: 8501 (HW-76246(App.I))
Variable coincidence circuit, 18: 8607 (HW-79222)
GENERAL ELECTRIC CO. MISSILE AND SPACE VEHICLE DEPT., BURLINGTON, VT.
Vehicle design for nuclear/electric spacecraft, 18: 9711 (63SD235)
GENERAL ELECTRIC CO. RESEARCH LAB., SCHENECTADY, N. Y.
Electromechanical gas valve, 18: 8510 (63-RL-3441E)
Electron temperature in theta pinch, 18: 9448 (63-RL-3414E)
Nonthermal ionization in electrodeless discharge in He seeded with Cs, 18: 8911 (63-RL-3382E)
Producing magnetic field in theta pinch experiment, 18: 9446 (63-RL-3254E(Rev.))
Prog. rpt. on superconducting properties of materials, 6/15–12/15/63, 18: 9262 (NP-13492)
Saturating reactor switch to excite high-frequency tank circuit, 18: 9447 (63-RL-3307E)
Stability of gas flow in MHD generator, 18: 9062 (63-RL-3506E)
GENERAL ELECTRIC CO. VALLECITOS ATOMIC LAB., SAN JOSE, CALIF.
Techniques in Zr alloy design program, 18: 8750 (GEAP-4453)
Uranium dioxide fuel rod center melting test, 18: 8720 (GEAP-4408)
GENERAL NUCLEAR ENGINEERING CORP., DUNEDIN, FLA.
Chloride deposition from steam on superheater fuel clad materials, 18: 8751 (GNEC-295)
GEORGIA. UNIV., ATHENS.
Reaction $Be^9(He^3,p)B^{11}$, 18: 9308 (CONF-374-1)
GHENT. RIJKSUNIVERSITEIT.
Prog. rpt. on design and construction of 6000-ton testing machine, 2–8/62, 18: 8504 (EURAEC-605)

GOODYEAR ATOMIC CORP., PIKETON, OHIO.
Cooling towers at Portsmouth Area diffusion plant, 18: 9749 (GAT-484)
Electrolytic removal of dissolved Cu from acid cleaning solutions, 18: 8444 (GAT-P-30)
GT. BRIT. AGRICULTURAL RESEARCH COUNCIL. NATIONAL INST. FOR RESEARCH IN DAIRYING, READING, ENGLAND.
Prog. rpt. on metabolism of fats in ruminant, 9/61–6/63, 18: 9772 (TID-19948)
GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE, HARWELL, BERKS, ENGLAND.
Beam-loading effects in Alvarez structure of accelerator, 18: 8954 (NIRL/M/34)
GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE. RUTHERFORD HIGH ENERGY LAB., CHILTON, BERKS, ENGLAND.
Geometry program for heavy liquid bubble chambers, 18: 8645 (NIRL/R/50)

H

HAHN-MEITNER-INSTITUT FÜR KERNFORSCHUNG BERLIN.
Prog. rpt. on diffusion of fission gases in fuels, 4–6/63, 18: 8736 (EURAEC-859)
HARVEY ALUMINUM, TORRANCE, CALIF.
Zirconium tubes with internal spiraled ribs, 18: 8773 (TID-19987)
HAWKER SIDDELEY CANADA LTD., TORONTO.
Hawker-Siddeley in-pile creep test facility, 18: 9730 (NP-13485)
HAZLETON-NUCLEAR SCIENCE CORP., PALO ALTO, CALIF.
Estimating underground movement of radioisotopes, 18: 8516 (HNS-1229-21)
HOLMES AND NARVER, INC., BERKELEY, CALIF.
Test reactor operating and safety experience, 18: 9725 (HN-172 (Vols.I&II))

I

IDAHO OPERATIONS OFFICE, AEC.
Economics of hydrocracking damaged coolant, 18: 9563 (IDO-11400)
Manual for operational documentary photography, 18: 9753 (IDO-10037(Rev.1))
Standard health and safety requirements, 18: 8547 (IDO-12028)
ILLINOIS INST. OF TECH., CHICAGO.
Chelate effect, 18: 9778 (TID-20012)
Interaction of uranyl ion with citric acid. II., 18: 8321 (CONF-175-3)
Interaction of uranyl ion with tartaric and malic acids. III., 18: 8397 (TID-20018)
Metal chelates of mercaptosuccinic and α,α'-dimercaptosuccinic acids, 18: 8394 (TID-20013)
Metal chelates of triethylenetetraminehexaacetic acid, 18: 8396 (TID-20015)
Mixed-ligand chelates of Th(IV), 18: 8395 (TID-20014)
ILLINOIS INST. OF TECH., CHICAGO. IIT RESEARCH INST.
Prog. rpt. on reactor containment, 8–9/63, 18: 9578 (IITRI-A6042-3)
ILLINOIS. UNIV., URBANA.
Observed asymmetry in β^p decay, 18: 9086 (TID-20011)
Prog. rpt. on radiation chemistry, 11/15/58–9/15/63, 18: 8408 (TID-20006)
Unsubtracted dispersion relations for weak interactions and the Goldberger-Treiman relation, 18: 9101 (UR-875-11(p.375-89))
INSTITUT DE SOUDURE, PARIS.
Prog. rpt. on elementary cracking, 6–9/63, 18: 8781 (EURAEC-881)
INSTITUTE FOR CANCER RESEARCH, PHILADELPHIA.
Prog. rpt. on modification of genetic damage produced by radiation, 9/60–11/63, 18: 8114 (TID-19991)
INSTITUTE FOR MATHEMATICAL SCIENCES, MADRAS.
Perturbation expansions, 18: 9216 (UR-875-11(p.411-21))
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Conference on operation of power reactors, Vienna, 6/63. II., 18: 9683
Conference on power reactor operation, Vienna, 6/63. I., 18: 9672 (STI/PUB/76(Vol.I))
Prog. rpt. on digestion of fats in ruminant, 1–6/63, 18: 9783 (TID-20028)
Prog. rpt. on phosphate metabolism of *E. Coli*, 18: 9782 (TID-20027)
Prog. rpt. on selection method for induced small mutations in higher plants, 2/61–10/63, 18: 8112 (TID-19964)
INTERNATIONAL BUSINESS MACHINES CORP., YORKTOWN HEIGHTS, N. Y.
Activation energies for diffusion and for Zener relaxation in dilute solid solutions, 18: 9773 (TID-19979)
ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Differentiation between atom and ion spectra of U and Eu, 18: 8913 (IA-841)
Highly excited nuclear bound levels using neutron capture γ rays, 18: 9310 (IA-863)
Research laboratories semi-annual report, 1–6/63, 18: 9752 (IA-900)
ISRAEL INST. OF TECH., HAIFA.
Measurement of tritium, 18: 8284 (TID-19994)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, CASACCIA.
Radioactivity collected by health physics service of C.S.N., Casaccia, 18: 8549 (RT/PROT(63)-4)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE. LABORATORI NAZIONALI, FRASCATI.
Higher resonances in pion-photoproduction and proton Compton effect, 18: 9082 (LNF-63/66)
Invariant phase-space integral for system of n particles, 18: 9083 (LNF-63/77)
Kinematic tables for photoproduction of two-body system, 18: 9081 (LNF-63/40)
Nonvanishing paramagnetic susceptibility in superconductors, 18: 9261 (LNF-63/71)

J

JACKSON AND MORELAND, INC., BOSTON.
Reactor fuel management program. II., 18: 9617 (NYO-9991)
Reactor fuel management program. I., 18: 9649 (NYO-9990)
JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
Effective Cd cutoff energy for cylindrical detectors with cylindrical filters, 18: 8644 (JAERI-1052)
Helium purification system of GCR, 18: 9648 (JAERI-1051)
JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Interaction constants in μ^- capture, 18: 9312 (JINR-E-1457)

K

KANSAS STATE UNIV., MANHATTAN.
Graphite subcritical reactor laboratory, 18: 9732 (TID-19943)
KENTUCKY. UNIV., LEXINGTON.
Trace element determinations in natural materials, 18: 8267 (CONF-151-4)
KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Bibliography on compressed air systems, 18: 9757 (KAPL-M-TL-1)
Corrosion of K-seals in 600°F ammoniated water, 18: 8753 (KAPL-M-SFB-1)
Determination of B in stainless steel, 18: 8271 (KAPL-M-SLJ-10)
DPL—program for decay power level, 18: 9564 (KAPL-M-CWS-8)
GEM—program for vibration studies, 18: 9754 (KAPL-M-EC-33)
LIZARD—program to solve non-linear, differential equations, 18: 9755 (KAPL-M-EC-36)
Neutron-diffusion problems in r-θ geometry, 18: 9292 (KAPL-M-DBM-3)
Potential-pH diagrams for Ni–H_2O, Cr–H_2O, and Fe–H_2O systems, 18: 8324 (KAPL-M-MSB-1)
Shock machine analysis, 18: 9756 (KAPL-M-LD-9)
SWAKRAUM—thermal program for Philco-2000, 18: 9293 (KAPL-M-RPC-10)
Two-phase fluid holdup vapor fractions, 18: 8482 (KAPL-2295)

L

LOCKHEED AIRCRAFT CORP., PALO ALTO, CALIF.
Radiation effects on infrared materials and components. II. PbS detectors, 18: 8869 (LMSD-5029)
LOS ALAMOS SCIENTIFIC LAB., N. MEX.

Contributions to high-pressure research from, 18: 9758 (LAMS-3011)
Fabrication of refractory metal shapes, 18: 8769 (LADC-5763)
Loss of Zr and U from fluidized beds of ZrC and UC–ZrC particles, 18: 8326 (LAMS-2994)
Post-fission β decay, 18: 9313 (LA-2811(Add.))
Preparation of americium metal, 18: 8325 (LA-2992)
Prestressed concrete spherical containment vessel, 18: 8462 (LA-2901)
Proposed Los Alamos meson project, 18: 8952 (LAMS-3025)
Rover reactor transient analyses, 18: 9718 (SC-DC-3553(p.155-65))
Safety in science, 18: 8553 (SC-DC-3553(p.19-21))
Status report on opacity calculations, 18: 8915 (LAMS-3002)

LOVELACE FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH, ALBUQUERQUE, N. MEX.
Data procurement and processing for fission product inhalation program, 18: 8609 (LF-13)

M

MARTIN-MARIETTA CORP. AEROSPACE DIV., BALTIMORE.
Characteristics of fuel compounds and encapsulation materials in radioisotope heat sources, 18: 9066 (MND-P-2975)
Gas pressure buildup in thermoelectric SNAP generators, 18: 9065 (MND-3143-1)
PM Core-2 critical experiments, 18: 9604 (MND-MD-2545)
Safety of isotopic SNAP generators, 18: 9069 (SC-DC-3553(p.91-102))

MARYLAND. UNIV., COLLEGE PARK.
Prog. rpt. on study of plankton nutrition and antibiosis using radioisotopes, 1–12/61, 18: 9759 (NYO-10700)

MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Electron energy gap in cutoff free approximation, 18: 9091 (UR-875-11(p.27-65))
Macroscopic theory of waves in plasmas, 18: 9467 (TID-19961)
Prog. rpt. on organic coolant materials, 7–9/63, 18: 8406 (MITNE-41)
Prog. rpt. on radiation effects on clams and haddock, 5/62–4/63, 18: 8110 (TID-19861)
Strong-coupling solutions of vector-coupled fields, 18: 9094 (UR-875-11(p.102-24))

MASSACHUSETTS INST. OF TECH., LEXINGTON. LINCOLN LAB.
Studies of F-region by incoherent backscatter method, 18: 9257 (NP-13527)

MAX-PLANCK-INSTITUT FÜR CHEMIE, MAINZ.
Diffusion loss of radiogenic and spallogenic rare gases for meteorites, 18: 8975 (NP-13496)
Helium and Ne isotopes in meteorites, 18: 8973 (NP-13494)
Production cross sections for He-3 and Ne-21 from Mg, Si, S, and Fe in meteorites, 18: 8976 (NP-13497)
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Radiogenic, spallogenic, and primordial rare gases in meteorites, 18: 8974 (NP-13495)

MAX-PLANCK-INSTITUT FÜR PHYSIK UND ASTROPHYSIK, MUNICH.
Nonlinear spinor model, 18: 9100 (UR-875-11(p.321-44))

METALLGESELLSCHAFT A. G., FRANKFURT AM MAIN.
Prog. rpt. on radiation effects on Zr–Nb–Sn alloy, 4–6/63, 18: 8735 (EURAEC-782)

MIAMI, FLA. UNIV., CORAL GABLES.
Crossed-field velocity analyzer in plasma diagnostics, 18: 9466 (TID-19928([Sect.2]))
Prog. rpt. on Neidigh arc, final, 6/10/60–9/30/63, 18: 9465 (TID-19928)

MICHIGAN. UNIV., ANN ARBOR.
Cavitation conditions from density profiles of Hg in a venturi, 18: 8484 (NP-13518)
Cavitation damage in Hg, 18: 8483 (NP-13517)
Polarographic determination of parabanic acid, 18: 9779 (TID-20016)

MIDWESTERN UNIVERSITIES RESEARCH ASSN., STOUGHTON, WIS.
Radio-frequency inflection into particle accelerator, 18: 8953 (MURA-674)

MINNESOTA. UNIV., MINNEAPOLIS.
Accelerator progress, 18: 8960 (TID-19940(p.1-21))
Experimental instrumentation, 18: 8649 (TID-19940(p.77-118))
Experimental program, 18: 9319 (TID-19940(p.22-76))
Prog. rpt. on electrical charging of particles, 1/15–9/15/63, 18: 8921 (TID-20020)
Prog. rpt. on linear accelerator, 12/62–11/63, 18: 8959 (TID-19940)
Theoretical program, 18: 8920 (TID-19940(p.119-39))

MISSOURI. UNIV., COLUMBIA.
Phosphorus metabolism in lambs. I., 18: 9776 (TID-20003)

MSA RESEARCH CORP., CALLERY, PENNA.
Effect of high-temperature Na on austenitic and ferritic steels, 18: 8754 (MSAR-63-168)
Prog. rpt. on effect of high-temperature Na on austenitic and ferritic steels, 11/63, 18: 8755 (MSAR-63-174)

N

NAGOYA, JAPAN. UNIV.
Characteristics of resonance probe, 18: 9456 (IPPJ-14)
Microwave radiation from plasma in magnetic field, 18: 9455 (IPPJ-13)
Resonance probe, 18: 9454 (IPPJ-10)

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Mass-spectrometric study of UP–UO_2 system, 18: 8333 (TID-19990 (Paper 8))

NATIONAL CARBON CO., LAWRENCEBURG, TENN.
Photomicrographic techniques for C and graphite, 18: 8802 (WADD-TR-61-72(Vol.XXII))

NATIONAL CARBON CO., PARMA, OHIO.
Specific heat of graphite, 18: 8804 (WADD-TR-61-72(Vol.XLI))
Thermal expansion of graphite, 18: 8803 (WADD-TR-61-72(Vol.XXIV))

NATIONAL INST. OF GENETICS, MISHIMA, JAPAN.
Prog. rpt. on genetics, annual, 1962, 18: 8046 (NP-13507)

NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
Dose rates in ducts using the Albedo concept, 18: 9555 (DASA-11.026)

NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Acid deoxyribonuclease in liver cell nuclei isolated in presence of Ca^{++}, 18: 9785 (USNRDL-TR-688)
Preservation of mouse lymphocytes with dimethyl sulfoxide, 18: 8048 (USNRDL-TR-689)
Radiosensitivity of bioelectric functions of stomach and caecum, 18: 8118 (USNRDL-TR-611)
Suppression of wound healing in mice graft vs host reaction, 18: 8119 (USNRDL-TR-683)

NEBRASKA. UNIV., LINCOLN.
Electron-voltaic cell study, 18: 9068 (SC-DC-3530)

NETHERLANDS. NIJVERHEIDSORGANISATIE, TNO, THE HAGUE.
Prog. rpt. on determination of ductile-brittle transition temperature, 7–9/63, 18: 8793 (EURAEC-827)

NEW BRUNSWICK LAB., AEC, N. J.
Analysis of K fluoborate, 18: 8272 (NBL-204(p.9-11))
Boron scrap recovery by pyrohydrolysis, 18: 8446 (NBL-206)
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Prog. rpt. on chemistry, 1–6/63, 18: 8264 (NBL-204)
Spectrochemical determination of B in Pu, 18: 8279 (NBL-204 (p.71-3))
Stability testing of $Pu(SO_4)_2 \cdot 4H_2O$ and Cs_2PuCl_6, 18: 8328 (NBL-204 (p.41-5))
Thermionic emission ion sources for isotopic analysis of Li, 18: 8280 (NBL-205)

NEW HAMPSHIRE. UNIV., DURHAM.
Prog. rpt. on displacement and exchange reactors involving organometallic compounds, annual, 1963, 18: 9775 (TID-19992)
NEW YORK OPERATIONS OFFICE, AEC.
Bibliography on radioisotope power supplies, 18: 8700 (NYO-10689)
NEW YORK OPERATIONS OFFICE. HEALTH AND SAFETY LAB., AEC.
Manual of standard procedures, HASL, 18: 8281 (NYO-4700(Rev.))
NEW YORK. STATE UNIV., BUFFALO.
Elastic and thermal properties of C-base bodies, 18: 8730 (WADC-TR-58-360(Pt.V))
NEW YORK UNIV., NEW YORK.
Aspects of Euclidean field theory and Feynman path integrals, 18: 9215 (UR-875-11(p.345-74))
NORTHEASTERN UNIV., BOSTON.
Interaction among gauge vector fields, 18: 9096 (UR-875-11(p.160-82))
NORTHERN STATES POWER CO., MINNEAPOLIS.
Bursup limits for boron–stainless steel control rods, 18: 9632 (ACNP-63006)
Pathfinder recirculation piping design, 18: 9633 (ACNP-63026)
Prog. rpt. on Pathfinder, 7–9/63, 18: 9634 (ACNP-63034)
NORTHWESTERN UNIV., EVANSTON, ILL.
Reaction of water vapor with solid BaO, 18: 9780 (TID-20017)
NORWAY. INSTITUTT FOR ATOMENERGI, KJELLER.
Effect on oscillation-induced burnout of fuel time constant, 18: 9616 (KR-61)
NUCLEAR MATERIALS AND EQUIPMENT CORP., APOLLO, PENNA.
Prog. rpt. on Pu-bearing fuel materials, 1–3/63, 18: 8772 (NUMEC-P-104)
NUCLEAR METALS, INC., WEST CONCORD, MASS.
Development of U SLIS alloys, 18: 8726 (NMI-2123(p.47-51))
Fabrication of W and W–Re tubing, 18: 8771 (NMI-2123(p.1-40))
Prog. rpt. on metallurgy, 11/63, 18: 8725 (NMI-2123)
Single-crystal deformation in zone-refined Be, 18: 8796 (NMI-2123 (p.41-6))
NUKLEARNI INSTITUT "JOSEF STEFAN," LJUBLJANA, YUGOSLAVIA.
Prog. rpt. on preparation of U carbides and cermets on UC base, 4–6/63, 18: 8778 (EURAEC-786)
Prog. rpt. on preparation of U carbides and cermets on UC base, 7–9/63, 18: 8780 (EURAEC-826)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Fuel cycle costs for Pu recycle system, 18: 9618 (ORNL-3501)
Scattering of molecules from surfaces, 18: 8914 (K-1584)
OAK RIDGE INST. OF NUCLEAR STUDIES, INC., TENN.
Reaction $Be^9(He^3,p)B^{11}$, 18: 9308 (CONF-374-1)
OAK RIDGE NATIONAL LAB., TENN.
Attenuation of solar flares by Al shields, 18: 9558 (ORNL-3520)
Calculations of thermal-neutron flux distributions in concrete-walled ducts, 18: 9557 (ORNL-3507)
Chromosomal aberrations in *Chironomus tentans* exposed to environmental radiation, 18: 8108 (ORNL-3531)
Fuel cycle costs for Pu recycle system, 18: 9618 (ORNL-3501)
MSRE design and operations. III., 18: 9650 (ORNL-TM-730)
Prestressing two-layer pressure vessel, 18: 8467 (ORNL-3546)
Radiation shielding characteristics of basic concrete, 18: 9556 (ORNL-3464)
Reaction $Be^9(He^3,p)B^{11}$, 18: 9308 (CONF-374-1)
Release of fission gases from UO_2 and ThO_2–UO_2, 18: 8727 (ORNL-TM-740)
Self-diffusion of Be in BeO, 18: 8798 (ORNL-3526)
Smallmouth buffalo in Watts Bar reservoir, 18: 8061 (ORNL-3530)
Solutions to age equation in finite systems, 18: 9294 (ORNL-TM-765)
Thermal conductivity of molten Li, 18: 8797 (ORNL-3390)
OHIO STATE UNIV. RESEARCH FOUNDATION, COLUMBUS.
Oxidation of U in continuously flowing moist gases, 18: 8756 (SC-DC-64-203)
Oxidation of U in moist gases, 18: 8757 (SC-DC-64-204)
ÖSTERREICHISCHE STUDIENGESELLSCHAFT FÜR ATOMENERGIE G.M.B.H., VIENNA.
Preparation of carrier-free I-131, 18: 8701 (SGAE-B-CH-2/1963)

P

P.E.C. CORP., BOULDER, COLO.
Prog. rpt. on excitation and ionization cross sections for photo processes, 6/61–8/63, 18: 8999 (TID-19958)
PANERO (GUY B.) ENGINEERS, NEW YORK.
Vulnerability of H_2O systems to fallout, 18: 8535 (AD-426044)
PARIS. UNIVERSITÉ.
Macroscopic theory of waves in plasmas, 18: 9467 (TID-19961)
PAVIA, ITALY. UNIVERSITÀ.
Prog. rpt. on mutability of polygenes, final, 1963, 18: 8107 (NYO-10620)
PENNSYLVANIA STATE UNIV., UNIVERSITY PARK.
Mass-spectrometric study of UP–UO_2 system, 18: 8333 (TID-19990 (Paper 8))
Prog. rpt. on high-temperature properties of Tr and Zr phosphides, 1–11/63, 18: 8799 (TID-19990)
Vaporization of transition metal phosphides, 18: 8800 (TID-19990 (Paper 3))
Zirconium phosphidation, 18: 8332 (TID-19990(Paper 5))
PENNSYLVANIA. UNIV., PHILADELPHIA.
Broken symmetries and unconventional solutions of standard, 18: 9095 (UR-875-11(p.125-59))
PHILLIPS PETROLEUM CO., IDAHO FALLS, IDAHO.
SNAP reactor transient tests, 18: 9715 (SC-DC-3553(p.65-78))
PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Prog. rpt. on fuel element development, 1963, 18: 8723 (IDO-16934)
Radiation effects on transducers and electrical cables, 18: 8608 (IDO-16914)
Total cross section of Pa-233, 18: 9309 (EANDC-US-44(L))
Transient tests of Spert I-D, Al-plate-type core, 18: 9729 (IDO-16886)
Uranium–Al alloy powders for fuels, 18: 8716 (CONF-339-5)
PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP. CONNECTICUT AIRCRAFT NUCLEAR ENGINE LAB., MIDDLETOWN.
Enthalpy and heat capacity of UC, 18: 8330 (PWAC-426)
PUBLIC HEALTH SERVICE, WASHINGTON, D. C.
Off-site radiological monitoring for missile test ranges, 18: 8556 (SC-DC-3553(p.255-8))

R

RADIATION APPLICATIONS INC., LONG ISLAND CITY, N. Y.
Radiation-induced gelation in monomer–polymer mixtures, 18: 8407 (RAI-329)
RADIO CORP. OF AMERICA. RCA LABS., PRINCETON, N. J.
Prog. rpt. on thermionic converters, final, 5/62–10/63, 18: 9063 (AD-425081)
RAND CORP., SANTA MONICA, CALIF.
Close-in EM fields produced by nuclear explosions, 18: 9258 (RM-3525-PR)
ROCHESTER, N. Y. UNIV.
Connection between Lorentz space and isotopic spin space, 18: 9213 (UR-875-11(p.251-73))
Proceedings of seminar on unified theories of elementary particles, Rochester, 7/63, 18: 9089 (UR-875-11)
RUTGERS UNIV., NEW BRUNSWICK, N. J.
Prog. rpt. on gas-solid suspension, 5–7/62, 18: 8464 (TID-19924)
Prog. rpt. on gas-solid suspension, 2–4/62, 18: 8465 (TID-19925)
Prog. rpt. on gas-solid suspension, 4–9/63, 18: 8466 (TID-19963)
Radiation damage of quartz and fused silica, 18: 8874 (NYO-2937-1)

S

SANDIA CORP., ALBUQUERQUE, N. MEX.
Air Force nuclear weapon safety program, 18: 8558 (SC-DC-3553 (p.361-6))
Conference on aerospace nuclear safety, Albuquerque, 10/63, 18: 8551 (SC-DC-3553)
Electron-voltaic cell study, 18: 9068 (SC-DC-3530)
Health physics aspects of Operation Roller Coaster, 18: 8550 (SC-4973(RR))
Oxidation of U in continuously flowing moist gases, 18: 8756 (SC-DC-

64-203)
Oxidation of U in moist gases, 18: 8757 (SC-DC-64-204)
Prog. rpt. on memory systems study, annual, 11/16/62–11/15/63, 18: 9760 (SC-DC-3568)
Radial distributions from optical measurements on cylindrical, 18: 9462 (SC-4938(RR))
Safety analysis of Sandia nuclear assembly, 18: 9731 (SC-4966(RR))
Safety of RIFT vehicle launch, 18: 9717 (SC-DC-3553(p.131-43))
Some geometric properties of hypercubes, 18: 9765 (SC-TM-356-63(91))
USAF aerospace nuclear safety program, 18: 8555 (SC-DC-3553 (p.47-51))

SANDIA LAB., ALBUQUERQUE, N. MEX.
Fixed water-vapor pressure generator, 18: 9762 (SC-TM-102-63(24))
Hypersonic plasma converter. I., 18: 9067 (SC-4960(RR))
Mass-spectrographic analysis of Er and Ce, 18: 9764 (SC-TM-343-63(14))
Nondestructive test for bridgewires, 18: 9761 (SC-DR-251-63)
Sandia APAR-3G system, 18: 8503 (SC-4944(RR))
Zero spring-rate mechanism, 18: 9763 (SC-TM-293-63(13))

SARGENT AND LUNDY, CHICAGO.
Prog. rpt. on D_2O-moderated power reactor plants, 4–6/62, 18: 9651 (SL-1974-1)

SASKATCHEWAN. UNIV., SASKATOON.
Shape of neutron pulses from U target, 18: 8955 (SAL-1)

SAVANNAH RIVER OPERATIONS OFFICE, AEC.
Prog. rpt. on D_2O power reactor program, 12/63, 18: 9652 (SRO-97)

SOCIÉTÉ ANONYME DES FORGES ET ATELIERS DU CREUSOT, LE CREUSOT, FRANCE.
Embrittlement of Mn–Mo welding steels, 18: 8807 (EURAEC-431)
Prog. rpt. on determination of essential parameters of welding cycles, 4–6/62, 18: 8776 (EURAEC-433)
Thermal behavior of UO_2 fuel, 18: 8808 (EURAEC-807)

SOCIÉTÉ BELGE POUR L'INDUSTRIE NUCLÉAIRE, BRUSSELS.
Determination of oxygen content of U–Pu mixed oxides, 18: 8290 (EURAEC-818)
Dissolution of PuO_2 in mixtures of HNO_3 and HF, 18: 8447 (EURAEC-708)

SOCIÉTÉ NATIONALE D'ÉTUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION, SURESNES, FRANCE.
Influence of critical fluxes of vortices induced in boiling water at low pressure, 18: 8492 (EURAEC-810)
Introduction of twisted tape in SENN-type subassembly, 18: 9625 (EURAEC-808)
Measurement of vacuum fraction on section-4 rods by γ ray absorption, 18: 8491 (EURAEC-809)

SPACE NUCLEAR PROPULSION OFFICE, AEC/NASA.
NASA aerospace nuclear safety philosophy, 18: 8554 (SC-DC-3553 (p.33-7))

STANFORD RESEARCH INST., MENLO PARK, CALIF.
Containment of fragments from runaway reactor, 18: 9565 (SRIA-43)
Radiological monitoring, 18: 8534 (AD-401687)

STANFORD UNIV., CALIF.
Bending magnet with nonsaturating shimming, 18: 8956 (SLAC-19)
Effects of stray magnetic fields in accelerator, 18: 8957 (SLAC-20)
N-dimensional Taylor and Lagrange operators, 18: 8708 (SLAC-22)
Pion photoproduction in H and Be, 18: 9318 (SLAC-21)
Prog. rpt. on plasma oscillations, 9–11/62, 18: 9464 (TID-18047)
Prog. rpt. on plasma oscillations, 6–8/63, 18: 9468 (TID-19974)
Prog. rpt. on two-mile accelerator project, 7–9/63, 18: 8958 (SLAC-23)

SYDNEY. UNIV.
Determination of plasma density distribution, 18: 9461 (NP-13531)
Production of hydrogenous plasmas by hydromagnetic ionizing fronts, 18: 9459 (NP-13529)
Production of pulsed magnetic fields for plasma physics research, 18: 9457 (NP-13514)
Prog. rpt. on plasma physics, 1–6/63, 18: 9458 (NP-13515)
Reflection of microwaves from anisotropic plasma, 18: 9460 (NP-13530)

T

TEMPLE UNIV., PHILADELPHIA.
Specific conductance and density measurements in fused alkali metal nitrate systems. I., 18: 8334 (TID-19997)
Specific conductance and density measurements in fused alkali metal nitrate systems. II., 18: 8335 (TID-19998)

TENNESSEE. UNIV., KNOXVILLE.
Chromosomal aberrations in *Chironomus tentans* exposed to environmental radiation, 18: 8108 (ORNL-3531)
Electron instability in cylindrical trochotron, 18: 9469 (TID-20009)
Thermal conductivity of molten Li, 18: 8797 (ORNL-3390)

TEXAS. AGRICULTURAL AND MECHANICAL COLL., COLLEGE STATION.
Goat incapacitation following neutron and γ irradiation, 18: 8109 (RTD-TDR-63-3077)

TEXAS. AGRICULTURAL AND MECHANICAL COLL., COLLEGE STATION. RESEARCH FOUNDATION.
Goat incapacitation following neutron and γ irradiation, 18: 8109 (RTD-TDR-63-3077)

TEXAS. UNIV., AUSTIN.
Prog. rpt. on hybrid ion-electron resonance, 6–11/63, 18: 9470 (TID-20033)
Radiation effects on natural populations, 18: 8113 (TID-19982)

TOKYO UNIV.
Mass differences of particles, 18: 9099 (UR-875-11(p.294-320))

TREFILERIES ET LAMINOIRS DU HAVRE. CENTRE DE RECHERCHES, ANTONY, FRANCE.
Prog. rpt. on sintering-extrusion of U–graphite powders, 12/61–12/62, 18: 8777 (EURAEC-749)

TURKEY. ATOMIC ENERGY COMMISSION. ÇEKMECE NUCLEAR RESEARCH CENTER, ISTANBUL.
Correlations in plasmas. II., 18: 9452 (CNAEM-11)

U

UNION CARBIDE NUCLEAR CO. Y-12 PLANT, OAK RIDGE, TENN.
Tooling development for high-pressure pressing, 18: 8775 (Y-DA-470)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. AUTHORITY HEALTH AND SAFETY BRANCH, RISLEY, LANCS, ENGLAND.
Conference on decontamination, Risley, 3/63, 18: 8536 (AHSB(S)R-57)
Criteria for criticality assessment, 18: 9060 (AHSB(S)R-56)
Safe handling of Zr, 18: 8542 (AHSB(S)R-59)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP, SPRINGFIELDS, LANCS, ENGLAND.
Spectrographic determination of Li, K, Ba, in U ores, 18: 8282 (PG-Report-497)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, DOUNREAY, CAITHNESS, SCOTLAND.
Autocode program to calculate fast-to-thermal flux ratio, 18: 9606 (TRG-Report-648)
Design and operation of Dounreay decontamination facilities, 18: 8541 (AHSB(S)R-57(p.50-60))
Transients due to reactivity insertions in fast reactors, 18: 9605 (TRG-Report-602)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, SPRINGFIELDS, LANCS, ENGLAND.
Elastoplastic thermal bowing of fuel pins for AGCR, 18: 9621 (TRG-Report-587)
Elastoplastic thermal bowing of fuel pins, 18: 9622 (TRG-Report-596)
Elastoplastic thermal bowing of fuel pins, 18: 9623 (TRG-Report-599)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP. ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORSET, ENGLAND.
STABLE—program for solving neutron-diffusion equation, 18: 9290 (AEEW-R-223)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Assessing decontaminable surfaces, 18: 8538 (AHSB(S)R-57(p.15-26))
Decontaminable surfaces, 18: 8537 (AHSB(S)R-57(p.1-14))
Design and operation of decontamination facilities at AERE, 18: 8540 (AHSB(S)R-57(p.41-9))

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP. CULHAM LAB., CULHAM, ABINGDON, BERKS, ENGLAND.
Effect of finite ion and electron temperatures on ion cyclotron resonance instability, 18: 9451 (CLM-R-32)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. WEAPONS GROUP. ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS, ENGLAND.
Best cross sections for U-238. I., 18: 9306 (AWRE-O-79/63)
Detex technique of decontamination, 18: 8539 (AHSB(S)R-57(p.27-40))
Electric and magnetic fluctuations in frequency band 0.1–10.0 c/s high-altitude nuclear explosions, 18: 9256 (AWRE-O-69/63))
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UNITED NUCLEAR CORP. DEVELOPMENT DIV., WHITE PLAINS, N. Y.
Neutron cross sections of Cl, 18: 9324 (UNC-5067)
Properties of mixed U–Pu carbides, final, 12/63, 18: 8729 (UNC-5074)
UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Determination of oxygen content of U–Pu mixed oxides, 18: 8290 (EURAEC-818)
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UTAH. UNIV., SALT LAKE CITY.
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VANDERBILT UNIV., NASHVILLE.
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SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. References to report numbers, where appropriate, are included after the abstract number of the citation. Published literature (journal article or book) is indentifiable by the absence of a report number.

General Indexing Style

The user should bear in mind that the ideas presented in the original literature, rather than key words, have been indexed. The indexers have tried to select what seemed the most probable and logical place to look for typical information. Since it is not possible to anticipate where a user would look for information, numerous cross references are included to assist him in his search.

Experience in using an index of this type will be the best guide in obtaining the desired information, and a consideration of synonymous or closely related terms will prove valuable.

Information must be so indexed as to be of the greatest use to the greatest number of users. This requires that a topic be indexed to headings that most specifically describe it and not ordinarily to the headings that describe its ultimate use, nor to the general class headings that include the specific headings. For example, information on the treatment of thyroid disease with I-131 would be indexed under Thyroid Diseases and under Iodine Isotopes I-131, but not necessarily under Radiotherapy. A study of the effects of x radiation on hair would be indexed under both X Radiation and Hair. However, the information would not be indexed under the experimental animal, e.g., Rats, unless the report discusses the effects on rat hair as compared with the effect on the hair of other animals.

The broad, general class headings are used only for general information or for comprehensive reports or articles.

Subject Heading Styles

Generally, the direct form of subject entry is used rather than inverted headings or, in some cases, subheadings; e.g., Amino Acids rather than Acids, amino; Helium Isotopes He-4 rather than Helium — isotopes He-4 or Helium — He-4 isotopes. Note, however, that in some cases modifying terms are used parenthetically in preference to a more direct type of entry which would result in the scattering of information. Organic compounds, however, are usually entered in the index in the inverted form so that substituted compounds can be listed near the parent compound; e.g., Benzene, Bromo- rather than Bromobenzene. In general, the style of nomenclature used is that of *Chemical Abstracts*, except that some items listed in that publication as subheadings are elevated to form part of the main heading; e.g., Butyric Acid, Methyl Ester rather than Butyric Acid — methyl ester.

Alphabetization

Main headings are arranged according to the widely accepted word-by-word alphabetic system. A parenthetic qualifier following a main heading is disregarded in alphabetizing unless there are two or more headings identical except for the parenthetic qualifier, in which case the qualifier determines the order. Headings involving Greek letters are arranged as if the names of the letters were spelled out, e.g., Mesons (π), Mesons (ζ).

Nomenclature of Inorganic Compounds

Inorganic compounds are indexed in the direct form, listing cations in the order of increasing valence in the case of polycationic salts of varying valence and in alphabetic order for polycationic salts in which all cations have the same valence; e.g., Sodium Aluminum Silicates and Potassium Sodium Sulfates.

Multicomponent Systems

Multicomponent alloys, except well-known trade names are indexed under each element in the alloy.

Example: Aluminum–Chromium Alloys are indexed

ALUMINUM ALLOYS
Al–Cr ...
CHROMIUM ALLOYS
Al–Cr ...

Well-known alloys such as Hastelloy are indexed directly with cross references under the element components. Multicomponent systems of elements are indexed similarly.

Example: Silicon–Tungsten Systems are indexed

SILICON SYSTEMS
Si–W ...
TUNGSTEN SYSTEMS
Si–W ...

Multicomponent systems of compounds are similarly indexed under the compound.

Physical States of Materials

In this subject index specification of the physical state of the material, if other than normal, is included in the modifying phrase.

Modifying Phrases (Subheadings)

Descriptive phrases (modifiers), rather than ordinary subheadings, are used under the main headings to give a better indication of the material covered in an abstract than would be possible with only a word or two whenever it appears that such information would be useful. Such phrases are written so that the idea considered most important is presented first, should a not-too-awkward expression result. However, when using this index, the reader is advised to scan all modifiers under a main heading to determine whether any abstracts in addition to the most obvious should be consulted for the desired information. Many of the modifiers are designed to be read in inverted order or to be read with the main heading inserted at the position of the comma in order to obtain a meaningful phrase; e.g., Uranium — allotropic transformation temperatures of, effect of cooling rate on is read "effect of cooling rate on allotropic transformation temperatures of uranium." In many cases, the prepositions have been omitted from such phrases provided no ambiguity results from the omission.

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63-RL-3307E	18-9447	
63-RL-3414E	18-9448	
63-RL-3506E	18-9062	
63-RL-3382E	18-8911	
63-RL-3441E	18-8510	
AAEC-TM–	**(Australian)**	
196	18-9297	J. Nucl. Energy, Pt. A & B, 17: 435(1963)
ABCC–		
24-62	18-9745	Dep.(mc); $3.60(fs), $1.31(mf) OTS
ACNP–		
63006	18-9632	Dep.(mc); $2.60(fs), $1.01(mf) OTS
63026	18-9633	$10.50(fs), $4.31(mf) OTS
63034	18-9634	Dep.(mc); $4.60(fs), $1.64(mf) OTS
ACRH–		
17	18-8044	Dep.(mc); $8.60(fs), $3.14(mf) OTS
AD–	**(Misc.)**	
271170	18-9449	Supplemented by AD-405732
290788	18-9305	$1.60(OTS); Phys. Rev. Letters, 12: 73-5 (1964)
297747	18-8118	See USNRDL-TR-611
401687	18-8534	$13.50(OTS)
402191	18-8195	
404119	18-8045	
404917	18-9258	See RM-3525-PR
405732	18-9449	
419181	18-9324	See UNC-5067
423952	18-8717	See DMIC-186
425037	18-8875	See REIC-ACCESS-69
425081	18-9063	$1.60(OTS)
425091	18-8196	$3.60(OTS)
425461	18-8474	See BSD-TDR-63-47
425518	18-8119	See USNRDL-TR-683
425604	18-8718	See DMIC-Memo-183
425654	18-9463	See SSD-TDR-63-261
426044	18-8535	$18.50(OTS)
426255	18-8790	See DMIC-188
426777	18-8109	See RTD-TDR-63-3077
426890	18-9785	See USNRDL-TR-688
426982	18-8048	See USNRDL-TR-689
AE–	**(Non-AEC)**	
128	18-8265	Dep.(mc)
AEC-tr–		
6049	18-8518	Dep.; (OTS)
6259	18-9786	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
6261	18-9787	Dep.(mc); $3.60(fs), $1.13(mf) JCL
6262	18-9788	Dep.(mc); $1.60(fs), $0.80(mf) JCL
6263	18-9789	Dep.(mc); $1.60(fs), $0.80(mf) JCL
6266	18-8289	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6268	18-8559	Dep.(mc); $1.10(fs), $0.80(mf) JCL
6269	18-9002	Dep.(mc); $2.60(fs), $0.89(mf) JCL
6281	18-9790	Dep.(mc); $2.60(fs), $1.01(mf) JCL or OTS
6282	18-8488	Dep.(mc); $1.60(fs), $0.80(mf) JCL
6285	18-9325	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
6287	18-8489	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
6291	18-8490	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
AECL–	**(Canadian)**	
1871	18-8916	See PR-P-59
AEEW-R–	**(British)**	
223	18-9290	Dep.(mc)
AERE-M–	**(British)**	
1185	18-8658	Nucl. Instr. Methods, 24: 441-4(1963)
AERE-R–	**(British)**	
4319	18-8785	Trans. AIME, 227: 1462-3(1963)
AHSB(S)–	**(British)**	
R-56	18-9060	Dep.; $0.60(BIS); 3s. (HMSO)
R-57	18-8536	Dep.; $1.20(BIS); 5s. 6d. (HMSO)
R-59	18-8542	Dep.; $1.00(BIS); 5s. (HMSO)
Al-Trans–		
28	18-9791	Dep.(mc); $1.10(fs), $0.80(mf) JCL
29	18-9792	Dep.(mc); $1.10(fs), $0.80(mf) JCL
30	18-9793	Dep.(mc); $3.60(fs), $1.22(mf) JCL
64-1	18-8805	Dep.(mc); $2.60(fs), $0.86(mf) JCL
64-3	18-9794	Dep.(mc); $1.60(fs), $0.80(mf) JCL
ANL–		
5719(Add.)	18-9635	Dep.; $4.00(OTS)
6632	18-9636	Dep.; $0.75(OTS)
6691	18-9601	Dep.; $0.75(OTS)
6763	18-8442	Dep.; $0.50(OTS)
6797(p.406-15)	18-9445	See CONF-346-3
APAE–	**(Misc.)**	
112(Vol.II)	18-8472	Dep.; $2.25(OTS)
ARL–	**(Non-AEC)**	
63-209	18-9509	Phys. Fluids, 7: 263-8(1964)
AWRE-O–	**(British)**	
68/63	18-9255	Dep.(mc)
69/63	18-9256	Dep.(mc)
79/63	18-9306	Dep.(mc)
BAW–	**(Misc.)**	
1287	18-8473	Dep.(mc); $1.60(fs), $0.80(mf) OTS
BMI–	**(Misc.)**	
1651	18-8712	Dep.; $0.50(OTS)
1658	18-8713	Dep.; $1.00(OTS)
BMI-X–		
10071	18-8747	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10074	18-9574	Dep.(mc); $2.60(fs), $0.95(mf) OTS
BN–	**(Misc.)**	
6212-03	18-8447	For translation see EURAEC-708
6306-02	18-8808	For translation see EURAEC-807
6306-03	18-8290	For translation see EURAEC-818
BNL–		
836	18-8714	Dep.; $2.00(OTS)
6981	18-8133	Arch. Pathol., 76: 527-36(1963)
7083	18-8070	Health Phys., 9: 1173-7(1963)
7103	18-9366	Nuovo Cimento (10), 30: 1379-95(1963)
7369	18-9013	Phys. Rev., 133: A990-1004(1964)
7510	18-8787	Dep.(mc); $1.10(fs), $0.80(mf) OTS J. Appl. Phys., 35: 1051-3(1964)
7522	18-8543	Dep.(mc); $1.10(fs), $0.80(mf) OTS
7541	18-8099	Dep.(mc); $2.60(fs), $0.98(mf) OTS
7542	18-8100	Dep.(mc); $2.60(fs), $1.01(mf) OTS
7557	18-9748	Dep.(mc); $2.60(fs), $0.89(mf) OTS
7581	18-8544	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7588	18-9080	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7592	18-9637	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7593	18-9638	Dep.(mc); $2.60(fs), $1.01(mf) OTS
7603	18-8101	Dep.(mc); $3.60(fs), $1.19(mf) OTS
7616	18-8640	Dep.(mc); $1.60(fs), $0.80(mf) OTS
7618	18-8951	Dep.(mc); $1.10(fs), $0.80(mf) OTS

Report No.	Abstract No.	Availability
7620	18-8102	$4.60(fs), $1.55(mf) OTS
7623	18-8788	Dep.(nc); $10.10(fs), $3.86(mf) OTS
BPSN–	**(Non-AEC)**	
63-6899-737102	18-9262	See NP-13492
BRB–		
79	18-8764	Dep.(nc); $4.60(fs), $1.43(mf) OTS
BRL-Memo–	**(Misc.)**	
1520	18-8461	Dep.(nc); $2.60(fs), $1.04(mf) OTS
BSD-TDR–	**(Non-AEC)**	
63-47	18-8474	$2.60(OTS)
CAPE–		
1025	18-8705	EM
1062	18-8440	EM
CEA–	**(French)**	
2353	18-9741	Dep.(nc)
2364	18-9450	Dep.(nc)
2380	18-9307	Dep.(nc)
CEA-Bib–	**(French)**	
36	18-8266	Dep.(nc)
CEND–	**(Misc.)**	
181	18-8765	Dep.(nc); $5.60(fs), $1.76(mf) OTS
186	18-8715	Dep.(nc); $10.10(fs), $3.92(mf) OTS
198	18-8748	Dep.(nc); $1.60(fs), $0.80(mf) OTS
CEX–		
59.7b(Part II)	18-8509	Dep.; $1.50(OTS)
CISE-R–	**(Italian)**	
79	18-8478	See EURAEC-862
84	18-8476	See EURAEC-830
85	18-9575	See EURAEC-831
CLM-R–	**(British)**	
26	18-9484	J. Nucl. Energy, Pt. C, 5: 345-53(1963)
32	18-9451	Dep.; $0.50(BIS); 2s. 6d. (HMSO)
CNAEM–	**(Turkish)**	
11	18-9452	Dep.(nc)
CONF-39–	**(American Nuclear Society 9th Annual Meeting, Salt Lake City, June 1963)**	
107	18-8867	See HW-SA-2909
CONF-102–	**(American Society of Mechanical Engineers 1963 Winter Meeting, Philadelphia, November 1963)**	
18	18-8500	New York, American Society of Mechanical Engineers, 1963, Paper No. 63-WA-98, ORINS
19	18-8905	New York, American Society of Mechanical Engineers, 1963, Paper No. 63-WA-135, ORINS
CONF-117–	**(American Chemical Society 145th National Meeting, New York, September 1963)**	
37	18-9046	ORINS. Gmelin, AED-CONF-63-133-45
CONF-122–	**(International Conference on Nucleon Structure, Stanford, Calif., June 1963)**	
20	18-9211	ORINS. Gmelin, AED-CONF-63-101-14
CONF-151–	**(19th International Union of Pure and Applied Chemistry Congress, London)**	
3	18-8268	See EUR-432.f
4	18-8267	Dep.(nc); $2.60(fs), $0.86(mf) OTS; ORINS
CONF-173–	**(Symposium on Ceramics in Aerospace Technology, Los Angeles, January 1963)**	
3	18-8907	See HW-SA-3192
CONF-174–	**(12th Annual Conference Application of X-ray Analysis, Denver, August 1963)**	
8	18-8635	ORINS. Gmelin, AED-CONF-63-123-23
10	18-8392	ORINS. Gmelin, AED-CONF-63-123-24
CONF-175–	**(American Chemical Society 142nd National Meeting, Atlantic City, September 1962)**	
3	18-8321	Dep.(nc); $2.60(fs), $1.04(mf) OTS
CONF-187–	**18-381**	**(American Nuclear Society Meeting, New York, November 1963)**
17	18-9727	See HW-SA-3008
33	18-8766	See HW-SA-3132
47	18-9580	See WAPD-T-1632
CONF-196–	**(American Institute of Chemical Engineers Northwest Regional Meeting, Portland, Oreg., October 1963)**	
2	18-9742	See HW-SA-3233
CONF-205–	**(International Atomic Energy Agency Symposium on the Biological Effects of Neutron Irradiations, Upton, N. Y., October 1963)**	
4	18-8099	See BNL-7541
11	18-8100	See BNL-7542
12	18-8101	See BNL-7603
CONF-207–	**(Second Yugoslavian Polish Symposium on Uranium Technology and Metallurgy, Zakopane, Poland, September 1963)**	
8	18-8786	ORINS
11	18-8460	ORINS
CONF-209–	**(American Vacuum Society Meeting, Boston, October 1963)**	
13	18-8514	ORINS. Gmelin, AED-CONF-63-161-16
14	18-8634	ORINS. Gmelin, AED-CONF-63-161-22
15	18-8633	ORINS. Gmelin, AED-CONF-161-23
16	18-8513	ORINS. Gmelin, AED-CONF-63-161-25
17	18-8632	ORINS. Gmelin, AED-CONF-63-161-27
18	18-8904	ORINS. Gmelin, AED-CONF-63-161-32
19	18-8950	ORINS. Gmelin, AED-CONF-63-161-36
CONF-212–	**(9th Annual Bioassay and Analytical Chemistry Conference, San Diego, October 1963)**	
6	18-8078	See HW-SA-3222
CONF-235–	**(2nd International Symposium on Effect of Ionizing Radiation on the Nervous System, Los Angeles, August 1963)**	
2	18-8102	See BNL-7620
CONF-243–	**(American Nuclear Society Conference on Problems of Operating Research and Power Reactors, Ottawa, October 1963)**	
23	18-8688	ORINS
41	18-9702	ORINS. Gmelin, AED-CONF-63-168-38
42	18-9740	ORINS. Gmelin, AED-CONF-63-168-39
43	18-9739	ORINS. Gmelin, AED-CONF-63-168-42
44	18-8906	ORINS. Gmelin, AED-CONF-63-168-47
45	18-9704	ORINS. Gmelin, AED-CONF-63-168-46
CONF-250–	**(American Physical Society 1963 Summer Meeting in the West, Edmonton, Can., August 1963)**	
1	18-8955	See SAL-1
14	18-9212	ORINS. Gmelin, AED-CONF-63-132-9
15	18-8970	ORINS. Gmelin, AED-CONF-63-132-10

Report No.	Abstract No.	Availability
16	18-9177	See UCRL-11003
CONF-251–	**(Rotating Machinery for Gas Cooled Reactor Application, Gatlinburg, Tenn., November 1963)**	
5	18-9728	See HW-SA-3232
CONF-255–	**(8th Air Cleaning Seminar, Oak Ridge, Tenn., October 1963)**	
11	18-8543	See BNL-7522
CONF-269–	**(International Atomic Energy Agency Symposium on Isotope Mass Effects in Chemistry and Biology, Vienna, December 1963)**	
5	18-8403	Vienna, IAEA, 1963, Preprint SM-50/31, ORINS
8	18-8529	Vienna, IAEA, 1963, Preprint SM-50/19, ORINS
9	18-8098	Vienna, IAEA, 1963, Preprint SM-50/12, ORINS
10	18-8402	Vienna, IAEA, 1963, Preprint SM-50/10, ORINS
11	18-8404	Vienna, IAEA, 1963, Preprint SM-50/8, ORINS
12	18-8391	Vienna, IAEA, 1963, Preprint SM-50/6, ORINS
13	18-8316	Vienna, IAEA, 1963, Preprint SM-50/2, ORINS
CONF-277–	**(Symposium on Radiation Emergencies in Medicine, Research, and Industry, Chicago, December 1963)**	
1	18-8546	See HW-SA-3285
CONF-284–	**(National Electronics Conference on Adaptive Processes, Chicago, October 1963)**	
7	18-9547	ORINS. Gmelin, AED-CONF-63-170-8
CONF-301–	**(International Conference on the Science of Superconductivity, Hamilton, New York, August 1963)**	
24	18-9260	Dep.(mc); $1.10(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-148-24
25	18-9280	ORINS. Gmelin, AED-CONF-301-25
CONF-310–	**(Symposium on Physics and Nondestructive Testing, San Antonio, October 1963)**	
2	18-8507	ORINS. Gmelin, AED-CONF-63-150-3
CONF-311–	**(American Nuclear Society Aerospace Nuclear Safety Safety National Topical Meeting, Albuquerque, New Mex., October 1963)**	
9	18-9712	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-163-9
CONF-313–	**(2nd National Meeting of the Society for Applied Spectroscopy, San Diego, Calif., October 1963)**	
3	18-8405	ORINS. Gmelin, AED-CONF-63-175-2
5	18-8642	See HW-SA-3225
CONF-317–	**(Proceedings of Symposium on Photosynthesis of Green Plants, Airlie, Va., October 1963)**	
4	18-8103	Dep.(mc); $1.10(fs), $0.80(mf) OTS
CONF-327–	**(Topical Conference on Compounds Nuclear States, Gatlinburg, Tenn., October 1963)**	
9	18-9440	ORINS. Gmelin, AED-CONF-63-162-15
11	18-9442	ORINS. Gmelin, AED-CONF-63-162-11
CONF-328–	**(American Physical Society Southeast Section 1963 Spring Meeting, Knoxville, Tenn., April 1963)**	
3	18-9441	ORINS. Gmelin, AED-CONF-63-160-2
4	18-9548	ORINS. Gmelin, AED-CONF-63-160-3
7	18-9045	ORINS. Gmelin, AED-CONF-63-160-7

Report No.	Abstract No.	Availability
CONF-332–	**(Symposium on Noise Analysis in Nuclear Systems, Gainesville, Fla., November 1963)**	
5	18-9609	ORINS. Gmelin, AED-CONF-63-215-5
7	18-9705	ORINS. Gmelin, AED-CONF-63-216-2
8	18-9639	Dep.(mc); $3.60(fs), $1.22(mf) OTS; Gmelin, AED-CONF-63-215-6
CONF-334–	**(Conference on Breeding Economics, and Safety in Large Fast Power Reactors, Argonne, Ill., October 1963)**	
6	18-9738	ORINS. Gmelin, AED-CONF-63-171-9
14	18-9700	ORINS. Gmelin, AED-CONF-63-171-14
16	18-9573	ORINS. Gmelin, AED-CONF-63-171-15
17	18-9629	ORINS. Gmelin, AED-CONF-63-171-16
18	18-9637	See BNL-7592
19	18-9638	See BNL-7593
20	18-9644	See GEAP-4414
CONF-337–	**(International Conference on Radioactive Pollution of Gaseous Media, Saclay, France, November 1963)**	
3	18-8544	See BNL-7581
CONF-339–	**(The Metallurgical Society of A.I.M.E. Fall Meeting, Cleveland, October 1963)**	
5	18-8716	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-176-7
CONF-340–	**(American Physical Society 1963 Autumn Meeting, Chicago, October 1963)**	
7	18-9443	ORINS. Gmelin, AED-CONF-63-169-9
8	18-9444	ORINS. Gmelin, AED-CONF-63-169-8
9	18-9550	ORINS. Gmelin, AED-CONF-63-169-4
CONF-342–	**(Conference on Magnetism and Materials, Atlantic City, November 1963)**	
6	18-8787	See BNL-7510
7	18-9279	ORINS. Gmelin, AED-CONF-63-218-11
CONF-345	**(American Physical Society New York State Section Fall Meeting, Olean, N. Y., October 1963)**	
1	18-8691	ORINS. Gmelin, AED-CONF-63-208-1
CONF-346–	**(International Conference on Nuclear Physics with Reactor Neutrons, Argonne, Ill., October 1963)**	
3	18-9445	ORINS. Gmelin, AED-CONF-63-201-2
CONF-354–	**(Accelerator Conference, Boston, Mass., November 1963)**	
3	18-8969	ORINS. Gmelin, AED-CONF-63-221-2
CONF-355–	**(Symposium in Medicine, Dynamic Clinical Studies with Radioisotopes, Oak Ridge, Tenn., October 1963)**	
1	18-8631	ORINS. Gmelin, AED-CONF-63-200-4
CONF-356–	**(1963 American Society of Metals/Metals and Materials Show, Cleveland, October 1963)**	
6	18-8502	See HW-SA-3108
7	18-8789	Dep.(mc); $4.60(fs), $1.46(mf) OTS
CONF-357–	**(National Power Conference, Cincinnati, September 1963)**	
1	18-8530	ORINS. Gmelin, AED-CONF-63-138-1
3	18-9703	ORINS. Gmelin, AED-CONF-63-138-3
CONF-359–	**(American Society of Civil Engineers Annual Meeting, San Francisco, October 1963)**	
2	18-9701	ORINS. Gmelin, AED-CONF-63-198-2
CONF-360–	**(American Nuclear Society Topical Meeting, Nuclear Performance Power Reactor Cores, San Francisco, September 1963)**	
8	18-9723	ORINS. Gmelin, AED-CONF-63-152-8
9	18-9640	Dep.(mc); $2.60(fs), $0.98(mf) OTS; Gmelin, AED-CONF-63-152-9

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10	18-9624	See WAPD-T-1608
CONF-361–	**(1963 Joint IEEE ASME Materials Handling Conference, Fort Monroe, Va., October 1963)**	
1	18-8592	ORINS. Gmelin, AED-CONF-63-177-1
CONF-363–	**(International Symposium on Plasma Phenomena, San Diego, Calif., October 1963)**	
8	18-9549	ORINS. Gmelin, AED-CONF-63-202-1
CONF-364–	**(16th Annual Gaseous Electronics Conference, Pittsburgh, October 1963)**	
1	18-8949	ORINS. Gmelin, AED-CONF-63-195-3
2	18-9551	ORINS. Gmelin, AED-CONF-63-195-2
3	18-9552	ORINS. Gmelin, AED-CONF-63-195-6
CONF-365–	**(Symposium on Environmental Monitoring, Berkeley, Gloucestershire, England, October 1963)**	
1	18-8248	ORINS
2	18-8602	ORINS
3	18-8603	ORINS
4	18-8689	ORINS
5	18-8595	ORINS
6	18-8594	ORINS
7	18-8598	ORINS
8	18-8593	ORINS
9	18-8251	ORINS
10	18-8589	ORINS
11	18-8590	ORINS
12	18-8591	ORINS
13	18-8588	ORINS
14	18-8698	ORINS
15	18-8599	ORINS
16	18-8690	ORINS
17	18-8600	ORINS
18	18-8597	ORINS
19	18-8587	ORINS
20	18-8601	ORINS
22	18-8249	ORINS
23	18-8250	ORINS
25	18-8596	ORINS
26	18-8586	ORINS
27	18-8604	ORINS
CONF-369–	**(International Symposium on Nuclear Electronics, Paris, November 1963)**	
2	18-8640	See BNL-7616
CONF-371–	**(American Oil Chemists Society 37th Annual Fall Meeting, Minneapolis, September 30–October 2, 1963)**	
1	18-8317	ORINS. Gmelin, AED-CONF-63-216-1
CONF-373–	**(Technical Conference on Applied Aspects of Refractory Metals, Los Angeles, December 1963)**	
1	18-8769	See LADC-5763
CONF-374–	**(American Physical Society Southeastern Section, Lexington, Ky., November 1963)**	
1	18-9308	Dep.(mc); $1.60(fs), $0.80(mf) OTS; Gmelin, AED-CONF-63-227-1
CONF-375–	**(6th National Symposium Society for Aerospace Material Process Engineers, Seattle, November 1963)**	
1	18-8768	See HW-SA-3264
2	18-8767	See HW-SA-3258
3	18-9713	Dep.(mc); $3.60(fs), $1.31(mf) OTS; Gmelin, AED-CONF-63-224-2
CONF-376–	**(50th Anniversary Celebration of French Biochemical Society, Paris, April 1964)**	
1	18-9748	See BNL-7557
CONF-377–	**(Annual Meeting of Northwest Scientific Association, Spokane, December 1963)**	
1	18-9751	See HW-SA-3280
CONF-379	**(Interplanetary Missions Conference 9th Annual American Astronautical Society Meeting, Los Angeles, January 1963)**	
1	18-9722	ORINS
CONF-380–	**(17th Meeting of the High Temperature Fuels Committee, San Ramon, Calif., December 1963)**	
1	18-8868	See HW-SA-3268
CONF-381–	**(International Symposium on Physical Processes in Radiation Biology, Ann Arbor, Mich., May 1963)**	
1	18-8077	Dep.(mc); $2.60(fs), $0.89(mf) OTS
CONF-382–	**(American Society of Heating, Refrigerating, and Air Conditioning Engineers Cryogenic Symposium, New York, February 1963)**	
1	18-8499	ORINS
CVNA–	**(Misc.)**	
188	18-9641	$21.00(fs), $11.60(mf) OTS
D–	**(Misc.)**	
1-82-0257	18-9047	
DASA–	**(Misc.)**	
11.026	18-9555	
DLCS–		
5001163	18-9642	Dep.(mc); $5.60(fs), $1.76(mf) OTS
DMIC–	**(Non-AEC)**	
186	18-8717	$1.75(OTS) as AD-423952
188	18-8790	$4.00(OTS)
DMIC-Memo–	**(Non-AEC)**	
183	18-8718	$1.25(OTS)
DP–		
841	18-8443	Dep.; $0.75(OTS)
864	18-9643	Dep.; $1.00(OTS)
DPST–		
63-69-11	18-9613	Dep.(mc); $1.10(fs), $0.80(mf) OTS
63-69-12	18-9614	Dep.(mc); $1.10(fs), $0.80(mf) OTS
63-74-10	18-8791	Dep.(mc); $1.10(fs), $0.80(mf) OTS
DRI–	**(Misc.)**	
2131	18-8792	Dep.(mc); $1.60(fs), $0.80(mf) OTS
2134	18-8749	Dep.(mc); $6.60(fs), $2.12(mf) OTS
DUBNA REPORTS–	**(Russian)**	
See JINR (Russian)		
EANDC-US–	**(European-American Nuclear Data Committee)**	
44(L)	18-9309	Dep.(mc); $1.10(fs), $0.80(mf) OTS
EU-B–	**(German)**	
25	18-8736	For translation see EURAEC-859
EUR–	**(European Atomic Energy Community)**	
421	18-8568	Proceedings of the International Symposium Held in Stresa-Ispra (Italy), May 2–5, 1961
432.f	18-8268	
EURAEC–		
59	18-8806	Dep.(mc); $3.60(fs), $1.19(mf) OTS

Report No.	Abstract No.	Availability
431	18-8807	Dep.(mc); $4.60(fs), $1.46(mf) OTS
433	18-8776	Dep.(mc); $2.60(fs), $1.07(mf) OTS
510	18-8731	Dep.(mc); $4.60(fs), $1.52(mf) OTS
566	18-8732	Dep.(mc); $1.60(fs), $0.80(mf) OTS
605	18-8504	Dep.(mc); $7.60(fs), $2.51(mf) OTS
661	18-8475	Dep.(mc); $3.60(fs), $1.31(mf) OTS
708	18-8447	Dep.(mc); $2.60(fs), $0.92(mf) OTS
734	18-8733	Dep.(mc); $4.60(fs), $1.46(mf) OTS
735	18-8734	Dep.(mc); $3.60(fs), $1.25(mf) OTS
746	18-8719	Dep.(mc); $3.60(fs), $1.28(mf) OTS
749	18-8777	Dep.(mc); $2.60(fs), $1.07(mf) OTS
781	18-9733	Dep.(mc); $7.60(fs), $2.45(mf) OTS
782	18-8735	Dep.(mc); $2.60(fs), $0.89(mf) OTS
786	18-8778	Dep.(mc); $1.10(fs), $0.80(mf) OTS
803(Pt.I)	18-9649	See NYO-9990
803(Pt.II)	18-9617	See NYO-9991
807	18-8808	Dep.(mc); $4.60(fs), $1.58(mf) OTS p.303-37 of "New Nuclear Materials Including Non-Metallic Fuels. Vol. II." Vienna, IAEA, 1963
808	18-9625	Dep.(mc); $8.60(fs), $3.14(mf) OTS
809	18-8491	Dep.(mc); $3.60(fs), $1.13(mf) OTS
810	18-8492	Dep.(mc); $4.60(fs), $1.43(mf) OTS
816	18-8877	Dep.(mc); $1.60(fs), $0.80(mf) OTS
817	18-8863	Dep.(mc); $2.60(fs), $1.01(mf) OTS
818	18-8290	Dep.(mc); $6.60(fs), $2.03(mf) OTS
820	18-8779	Dep.(mc); $5.60(fs), $1.79(mf) OTS
825	18-8485	See NYO-10488
826	18-8780	Dep.(mc); $1.60(fs), $0.80(mf) OTS
827	18-8793	Dep.(mc); $4.60(fs), $1.52(mf) OTS
830	18-8476	Dep.(mc); $1.10(fs), $0.80(mf) OTS
831	18-9575	Dep.(mc); $1.60(fs), $0.80(mf) OTS
856	18-8477	Dep.(mc); $5.60(fs), $1.73(mf) OTS
859	18-8736	Dep.(mc); $1.60(fs), $0.80(mf) OTS
862	18-8478	Dep.(mc); $8.10(fs), $2.81(mf) OTS
876	18-8291	Dep.(mc); $1.60(fs), $0.80(mf) OTS
881	18-8781	Dep.(mc); $1.60(fs), $0.80(mf) OTS
885	18-8479	Dep.(mc); $8.10(fs), $2.63(mf) OTS
891	18-8782	Dep.(mc); $8.10(fs), $2.72(mf) OTS
902	18-8748	See CEND-198
904	18-8715	See CEND-186
905	18-8765	See CEND-181
918	18-8729	See UNC-5074
937	18-9574	See BMI-X-10074
938	18-8747	See BMI-X-10071
940	18-8481	See GEAP-4487
947	18-8750	See GEAP-4453
GA–	(Misc.)	
4005	18-9515	Phys. Fluids, 7: 311-?(1964)
4012	18-9064	OTS
4132	18-9291	
4843	18-9453	
GAMD–	(Misc.)	
4441	18-8794	Dep.(mc); $1.60(fs), $0.80(mf) OTS
4691	18-9576	Dep.(mc); $2.60(fs), $0.83(mf) OTS
GAT–		
484	18-9749	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GAT-P–		
30	18-8444	Dep.(mc); $1.60(fs), $0.80(mf) OTS
GEAP–	(Misc.)	
4395	18-8480	Dep.(mc); $2.60(fs), $0.86(mf) OTS
4408	18-8720	Dep.(mc); $5.60(fs), $1.88(mf) OTS
4414	18-9644	Dep.(mc); $1.60(fs), $0.80(mf) OTS
4420	18-9602	Dep.(mc); $2.60(fs), $0.98(mf) OTS
4453	18-8750	Dep.(mc); $2.60(fs), $1.07(mf) OTS
4487	18-8481	Dep.(mc); $2.60(fs), $0.95(mf) OTS
GNEC–		
295	18-8751	Dep.(mc); $11.50(fs), $4.88(mf) OTS
HN–		
172(Vols.I&II)	18-9725	Dep.; $5.00(OTS)
HNS–		
1229-21	18-8516	Dep.(mc); $2.60(fs), $0.98(mf) OTS
HW–		
61240	18-9645	Dep.(mc); $2.60(fs), $0.92(mf) OTS
63985	18-8269	Dep.(mc); $2.60(fs), $0.95(mf) OTS
68600-34	18-9750	Dep.; $0.50(OTS)
69234	18-8864	Dep.; $0.75(OTS)
69724	18-9726	$1.10(fs), $0.80(mf) OTS
72031	18-8795	Dep.; $0.50(OTS)
74555	18-8270	Dep.(mc); $1.10(fs), $0.80(mf) OTS
76246(App.I)	18-8501	$7.60(fs), $2.54(mf) OTS
76279	18-8641	Dep.; $3.00(OTS)
77147	18-9603	Dep.(mc); $2.60(fs), $1.01(mf) OTS
78180	18-8699	Dep.(mc); $1.10(fs), $0.80(mf) OTS
78332	18-9577	Dep.(mc); $3.60(fs), $1.19(mf) OTS
78388	18-9562	Dep.; $2.50(OTS)
78395	18-8545	Dep.; $0.75(OTS)
78549	18-8722	Dep.(mc); $1.10(fs), $0.80(mf) OTS
79022	18-9707	Dep.(mc); $1.60(fs), $0.80(mf) OTS
79222	18-8607	Dep.(mc); $1.60(fs), $0.80(mf) OTS
79316	18-9708	Dep.(mc); $1.10(fs), $0.80(mf) OTS
79356	18-9709	Dep.(mc); $1.10(fs), $0.80(mf) OTS
HW-SA–		
2887	18-8069	Health Phys., 9: 1167-71(1963)
2909	18-8867	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3008	18-9727	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3072	18-8084	Health Phys., 9: 1217-20(1963)
3073	18-8085	Health Phys., 9: 1223-6(1963)
3074	18-8086	Health Phys., 9: 1231-4(1963)
3076	18-8162	Health Phys., 9: 1363-8(1963)
3087	18-8688	See CONF-243-23
3108	18-8502	Dep.(mc); $2.60(fs), $0.86(mf) OTS
3132	18-8766	Dep.(mc); $2.60(fs), $0.86(mf) OTS
3142	18-8068	Health Phys., 9: 1159-66(1963)
3192	18-8907	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3202	18-8089	Health Phys., 9: 1399-1410(1963)
3222	18-8078	Dep.(mc); $1.10(fs), $0.80(mf) OTS
3225	18-8642	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3232	18-9728	Dep.(mc); $1.10(fs), $0.80(mf) OTS
3233	18-9742	Dep.(mc); $2.60(fs), $0.83(mf) OTS
3258	18-8767	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3264	18-8768	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3268	18-8868	Dep.(mc); $3.60(fs), $1.34(mf) OTS
3280	18-9751	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3285	18-8546	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3294	18-9647	Dep.(mc); $3.60(fs), $1.34(mf) OTS
IA–	(Non-AEC)	
841	18-8913	Dep.(mc)
863	18-9310	Dep.(mc); Phys. Rev., 133: B684-700(1964)
900	18-9752	Dep.(mc)
IDO–		
10037(Rev.1)	18-9753	Dep.; $0.50(OTS)
11400	18-9563	Dep.; $1.25(OTS)
12028	18-8547	Dep.; $18.00(fs), $8.72(mf) OTS
16886	18-6729	Dep.; $1.50(OTS)
16914	18-8608	Dep.; $0.75(OTS)
16934	18-8723	Dep.; $1.50(OTS)
IITRI–	(Misc.)	
A6042-3	18-9578	Dep.(mc); $3.60(fs), $1.40(mf) OTS

Report No.	Abstract No.	Availability
IMP-AEC–		
26	18-8933	Phys. Fluids, 7: 174-9(1964)
IPPJ–	**(Japanese)**	
10	18-9454	Dep.(mc)
13	18-9455	Dep.(mc)
14	18-9456	Dep.(mc)
IS–		
558	18-9311	Dep.; $2.00(OTS)
575	18-8643	Dep.; $1.50(OTS)
598	18-8322	Dep.; $2.25(OTS)
648	18-8297	Anal. Chim. Acta, 29: 532-8(1963)
722	18-8724	Dep.; $2.00(OTS)
729	18-8359	J. Chem. Phys., 40: 248(1964)
742	18-8323	Dep.; $1.25(OTS)
765	18-8706	Dep.; $0.50(OTS)
769	18-8707	Dep.; $1.25(OTS)
JAERI–	**(Japanese)**	
1051	18-9648	
1052	18-8644	Dep.(mc)
JINR–	**(Russian)**	
E-1457	18-9312	Dep.(mc)
JPRS–	**(Non-AEC)**	
22556	18-8120	$0.75(OTS)
22588	18-9263	$0.50(OTS)
22593	18-8809	$0.50(OTS)
22597	18-8783	$0.50(OTS)
22613(Del.)	18-8123	OTS
22656	18-8064	$0.50(OTS)
K–		
1584	18-8914	Dep.; $0.50(OTS)
KAPL–		
2295	18-8482	Dep.(mc); $1.60(fs), $0.80(mf) OTS
KAPL-M–		
CWS-8	18-9564	Dep.(mc); $2.60(fs), $0.89(mf) OTS
DBM-3	18-9292	Dep.(mc); $2.60(fs), $0.86(mf) OTS
EC-33	18-9754	Dep.(mc); $2.60(fs), $1.01(mf) OTS
EC-36	18-9755	Dep.(mc); $2.60(fs), $0.89(mf) OTS
LD-9	18-9756	Dep.(mc); $2.60(fs), $0.89(mf) OTS
MSB-1	18-8324	Dep.(mc); $1.60(fs), $0.80(mf) OTS
RPC-10	18-9293	Dep.(mc); $3.60(fs), $1.16(mf) OTS
SFB-1	18-8753	Dep.(mc); $1.60(fs), $0.80(mf) OTS
SLJ-10	18-8271	Dep.(mc); $3.60(fs), $1.37(mf) OTS
TL-1	18-9757	Dep.(mc); $1.60(fs), $0.80(mf) OTS
KAPL-P–		
2276	18-9799	Metal Progr., 122-3; 46(1963)
KR–	**(Norwegian)**	
61	18-9616	Dep.(mc)
LA–		
2811(Add.)	18-9313	Dep.; $0.75(OTS)
2901	18-8462	Dep.; $1.50(OTS)
2992	18-8325	Dep.; $1.60(fs), $0.80(mf) OTS
LADC–		
5763	18-8769	Dep.(mc); $1.60(fs), $0.80(mf) OTS
5874	18-8296	Anal. Chem., 35: 431-2(1964)
5890	18-9391	Phys. Rev., 133: B613-24(1964)
5891	18-8366	J. Phys. Chem., 68: 147-51(1964)
5942	18-9390	Phys. Rev., 133: B603-12(1964)
LAMS–		
2994	18-8326	Dep.; $1.25(OTS)
3002	18-8915	Dep.; $1.75(OTS)
3011	18-9758	Dep.; $0.75(OTS)
3025	18-8952	Dep.; $0.75(OTS)
LF–		
13	18-8609	Dep.; $0.50(OTS)
LMSD–	**(Non-AEC)**	
5029	18-8869	
LNF–	**(Italian)**	
63/40	18-9081	Dep.(mc)
63/66	18-9082	Dep.(mc)
63/71	18-9261	Dep.(mc)
63/77	18-9083	Dep.(mc)
MATT–		
191	18-9511	Phys. Fluids, 7: 278-83(1964)
192	18-9487	J. Nucl. Energy, Pt. C, 5: 368-9(1963)
204	18-9512	Phys. Fluids, 7: 284-91(1964)
216	18-9508	Phys. Fluids, 7: 257-62(1964)
219	18-9528	Rev. Sci. Instr., 35: 40-6(1964)
234	18-9527	Phys. Rev. Letters, 12: 121-3(1964)
MITNE–	**(Misc.)**	
41	18-8406	Dep.(mc); $2.60(fs), $1.04(mf) OTS
ML–	**(Misc.)**	
999	18-9464	See TID-18047
1101	18-9468	See TID-19974
MND–	**(Misc.)**	
3143-1	18-9065	Dep.(mc); $4.60(fs), $1.49(mf) OTS
MND-MD–		
2545	18-9604	Dep.(mc); $7.60(fs), $2.57(mf) OTS
MND-P–		
2975	18-9066	Dep.(mc); $1.60(fs), $0.80(mf) OTS
MSAR–	**(Misc.)**	
63-168	18-8754	Dep.(mc); $8.60(fs), $3.02(mf) OTS
63-174	18-8755	Dep.(mc); $4.60(fs), $1.55(mf) OTS
MURA–	**(Misc.)**	
674	18-8953	Dep.; $3.00(OTS)
NAA-SR–		
6262	18-8870	Dep.; $0.50(OTS)
NAA-SR-Memo–		
8528	18-8770	Dep.(mc); $3.60(fs), $1.37(mf) OTS
8807	18-8610	Dep.(mc); $1.60(fs), $0.80(mf) OTS
NBL–		
204	18-8264	Dep.; $1.75(OTS)
205	18-8280	Dep.; $0.50(OTS)
206	18-8446	Dep.; $0.50(OTS)
NIRL-M–	**(British)**	
34	18-8954	Dep.(mc)
NIRL-R–	**(British)**	
50	18-8645	Dep.(mc); $0.50(BIS); 2s. 6d. (HMSO)
NMI–	**(Misc.)**	
2123	18-8725	Dep.(mc); $5.60(fs), $1.91(mf) OTS
NP–	**(AEC File No. for Non-AEC Reports)**	
12980	18-9579	Dep.; $0.50(OTS)

Report No.	Abstract No.	Availability
13468	18-9714	
13483	18-9315	Dep.(mc)
13484	18-9084	Dep.(mc)
13485	18-9730	
13492	18-9262	
13493	18-8972	Dep.(mc)
13494	18-8973	Dep.(mc)
13495	18-8974	Dep.(mc)
13496	18-8975	Dep.(mc)
13497	18-8976	Dep.(mc)
13503	18-8871	
13504	18-8872	
13505	18-8873	
13507	18-8046	Dep.(mc)
13510	18-9316	Dep.(mc)
13514	18-9457	Dep.(mc)
13515	18-9458	Dep.(mc)
13517	18-8483	
13518	18-8484	
13525	18-8612	Dep.(mc)
13527	18-9257	
13529	18-9459	Dep.(mc)
13530	18-9460	Dep.(mc)
13531	18-9461	Dep.(mc)
13532	18-9085	Dep.(mc)
NP-tr-	**(AEC File No. for Non-AEC Translations)**	
1087	18-8253	Dep.(mc); $5.60(fs), $1.91(mf) JCL
NUMEC-P-		
104	18-8772	Dep.(mc); $4.60(fs), $1.70(mf) OTS
NYO-		
2740-1	18-8047	Dep.(mc); $13.50(fs), $6.08(mf) OTS
2937-1	18-8874	Dep.(mc); $1.10(fs), $0.80(mf) OTS
4700(Rev.)	18-8281	Dep.; $5.50(OTS)
9990	18-9649	Dep.; $2.50(OTS)
9991	18-9617	Dep.; $3.00(OTS)
10266	18-9115	Nuovo Cimento (10), 30: 845-58(1963)
10488	18-8485	Dep.(mc); $4.60(fs), $1.46(mf) OTS
10620	18-8107	Dep.(mc); $1.60(fs), $0.80(mf) OTS
10689	18-8700	Dep.(mc); $2.60(fs), $1.10(mf) OTS
10700	18-9759	Dep.(mc); $4.60(fs), $1.46(mf) OTS
10723	18-8613	Dep.(mc); $1.10(fs), $0.80(mf) OTS
ORA-	**(Misc.)**	
03424-10-T	18-8483	See NP-13517
03424-11-T	18-8484	See NP-13518
ORNL-		
3390	18-8797	Dep.; $2.75(OTS)
3464	18-9556	Dep.; $1.75(OTS)
3501	18-9618	Dep.; $1.00(OTS)
3507	18-9557	Dep.; $2.75(OTS)
3520	18-9558	Dep.; $0.50(OTS)
3526	18-8798	Dep.; $0.75(OTS)
3530	18-8061	Dep.; $9.10(fs), $3.32(mf) OTS
3531	18-8108	Dep.; $8.10(fs), $2.84(mf) OTS
3546	18-8467	Dep.; $0.75(OTS)
ORNL-TM-		
575	18-8829	J. Appl. Phys., 35: 435-8(1964)
730	18-9650	Dep.(mc); $14.00(fs), $6.32(mf) OTS
740	18-8727	Dep.(mc); $1.10(fs), $0.80(mf) OTS
765	18-9294	Dep.(mc); $1.10(fs), $0.80(mf) OTS
ORO-		
612	18-8694	Dep.; $2.00(OTS)
OTS-	**(Misc.)**	
22593	18-8809	For translation see JPRS-22593
64-21184	18-8120	For translation see JPRS-22556
64-21197	18-9263	For translation see JPRS-22588
64-21205	18-8783	For translation see JPRS-22597
64-21215(Del.)	18-8123	For translation see JPRS-22613(Del.)
64-21238	18-8064	For translation see JPRS-22656
PATENTS	**(British)**	**3s. 6d. each, U. K. Patent Office**
940,215	18-8469	
940,474	18-8636	
942,019	18-8741	
942,374	18-8060	
942,609	18-8508	
942,667	18-9304	
942,705	18-9553	
942,706	18-9554	
942,832	18-8742	
942,852	18-9630	
942,853	18-8743	
942,945	18-8744	
943,119	18-8441	
946,477	18-8605	
946,568	18-8745	
946,599	18-8637	
946,655	18-8470	
946,803	18-9587	
946,885	18-9724	
946,901	18-9612	
PATENTS	**(French)**	
73,194	18-9588	See French Patent 1,129,103(Add.1)
1,129,103(Add.1)	18-9588	
1,289,985	18-9589	
1,295,806	18-9079	
1,298,516	18-9590	
1,299,705	18-9591	
1,305,489	18-9592	
1,306,711	18-9593	
1,307,044	18-9594	
1,307,589	18-9595	
1,310,151	18-9596	
1,311,324	18-9597	
1,313,498	18-9598	
PATENTS	**(German)**	
1,153,465	18-9631	
1,153,470	18-8971	
1,153,550	18-8318	
1,153,838	18-8692	
1,154,881	18-8263	
1,155,254	18-8746	
1,155,924	18-8319	
1,156,516	18-9599	
1,156,903	18-9706	
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,116,757	18-9600	
3,116,767	18-8471	
3,117,224	18-8638	
3,117,225	18-8320	
3,117,229	18-8693	
3,117,230	18-8639	
PG-Report-	**(British)**	
497	18-8282	Dep.; $0.60(BIS); 3s. (HMSO)
PPAD-		
489-E	18-9419	Phys. Rev., 133: B976-82(1964)
PR-P-	**(Canadian)**	
59	18-8916	Dep.; $2.00(AECL)

Report No.	Abstract No.	Availability
PUC–		
1963-115	18-9415	Phys. Rev., 133: B934-48(1964)
PWAC–	(Misc.)	
426	18-8330	Dep.; $0.50(OTS)
RAI–	(Misc.)	
329	18-8407	Dep.; $2.25(OTS)
REIC-ACCESS–	(Non-AEC)	
69	18-8875	$2.60(OTS)
70	18-8876	$1.60(OTS)
RFP–		
357	18-8331	Dep.(mc); $2.60(fs), $1.01(mf) OTS
RISO–	(Danish)	
38	18-8615	Dep.(mc)
67	18-8648	Dep.(mc)
RM–	(Misc.)	
3525-PR	18-9258	$4.60(OTS)
RT-PROT–	(Italian)	
(63)-4	18-8549	Dep.(mc)
RTD-TDR–	(Non-AEC)	
63-3077	18-8109	$15.50(OTS)
63-4190	18-9064	See GA-4012
SAL–	(Canadian)	
1	18-8955	Dep.(mc)
SAN–		
1010	18-8486	Dep.(mc); $8.60(fs), $3.14(mf) OTS
SC–	(Misc.)	
4938(RR)	18-9462	Dep.; $0.50(OTS)
4944(RR)	18-8503	Dep.; $0.75(OTS)
4960(RR)	18-9067	Dep.; $0.75(OTS)
4966(RR)	18-9731	Dep.(mc); $7.60(fs), $2.60(mf) OTS
4973(RR)	18-8550	Dep.; $0.75(OTS)
SC-T–		
64-40	18-9795	Dep.(mc); $2.60(fs), $0.95(mf) JCL
64-41	18-9796	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
SC-DC–		
3530	18-9068	Dep.(mc); $5.60(fs), $1.94(mf) OTS
3553	18-8551	Dep.; $4.50(OTS)
3568	18-9760	Dep.(mc); $7.60(fs), $2.60(mf) OTS
64-203	18-8756	Dep.(mc); $5.60(fs), $1.85(mf) OTS
64-204	18-8757	Dep.(mc); $8.10(fs), $2.81(mf) OTS
SCDC–		
3092	18-8560	See TID-18082
SC-DR–		
251-63	18-9761	Dep.(mc); $1.60(fs), $0.80(mf) OTS
SC-TM–		
102-63(24)	18-9762	Dep.(mc); $1.10(fs), $0.80(mf) OTS
293-63(13)	18-9763	Dep.(mc); $1.60(fs), $0.80(mf) OTS
343-63(14)	18-9764	Dep.(mc); $1.10(fs), $0.80(mf) OTS
356-63(91)	18-9765	Dep.(mc); $1.60(fs), $0.80(mf) OTS
SGAE-B–	(Austrian)	
CH-2/1963	18-8701	Dep.
SL–	(Misc.)	
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